S12
A3m
Room 2nd floor

PUBLIC LIBRARY
APR 3 1963
DETROIT

NUCLEAR SCIENCE ABSTRACTS

Volume 17 Number 5

Abstracts 5654–7654

March 15, 1963

UNITED STATES ATOMIC ENERGY COMMISSION
Division of Technical Information

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U. S. that are abstracted in *Nuclear Science Abstracts*.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library
ARIZONA
Tucson, University of Arizona
ARKANSAS
Fayetteville, University of Arkansas
CALIFORNIA
Berkeley, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library
COLORADO
Boulder, University of Colorado
Denver, Public Library
CONNECTICUT
New Haven, Yale University
DELAWARE
Newark, University of Delaware
DISTRICT OF COLUMBIA
Washington, Library of Congress
FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida
GEORGIA
Atlanta, Georgia Institute of Technology
HAWAII
Honolulu, University of Hawaii
ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois
INDIANA
Indianapolis, Public Library
Lafayette, Purdue University
IOWA
Ames, Iowa State University
KANSAS
Manhattan, Kansas State University
KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville
LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University
MARYLAND
Baltimore, Johns Hopkins University
MARYLAND (CONT.)
College Park, University of Maryland
MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology
MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library
MINNESOTA
Minneapolis, University of Minnesota
MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University
MONTANA
Bozeman, Montana State College
NEVADA
Reno, University of Nevada
NEW JERSEY
Princeton, Princeton University
Teaneck, Fairleigh Dickinson University
NEW MEXICO
Albuquerque, University of New Mexico
NEW YORK
Buffalo, University of Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, Public Library
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute
NORTH CAROLINA
Charlotte, Charlotte and Mecklenburg County Public Library
Durham, Duke University
Raleigh, North Carolina State College
NORTH DAKOTA
Grand Forks, University of North Dakota
OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library
Columbus, Ohio State University
OHIO (CONT.)
Toledo, University of Toledo
Youngstown, Youngstown University
OKLAHOMA
Norman, University of Oklahoma
Stillwater, Oklahoma State University
OREGON
Corvallis, Oregon State College
Portland, Reed College
PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University
PUERTO RICO
Rio Piedras, University of Puerto Rico
RHODE ISLAND
Providence, Brown University
SOUTH CAROLINA
Columbia, University of South Carolina
TENNESSEE
Knoxville, University of Tennesse
Memphis, Public Library
Nashville, Joint University Libraries
Oak Ridge, Oak Ridge Institute of Nuclear Studies
TEXAS
Austin, University of Texas
College Station, Agricultural and Mechanical College of Texas
Dallas, Southern Methodist University
Houston, Rice Institute
San Antonio, Public Library
UTAH
Salt Lake City, University of Utah
VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia
WASHINGTON
Pullman, Washington State University
Seattle, University of Washington
WEST VIRGINIA
Morgantown, West Virginia University
WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library
WYOMING
Laramie, University of Wyoming

Volume 17, Number 5, March 15, 1963

NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USAEC Division of Technical Information, Edward J. Brunenkant, Director. Published by the USAEC Division of Technical Information Extension, Robert L. Shannon, Extension Manager.

NUCLEAR SCIENCE ABSTRACTS is the only comprehensive abstracting and indexing service devoted solely to the literature of nuclear science and technology. Published twice each month since 1947, NSA provides coverage of (1) technical reports of the United States Atomic Energy Commission and its contractors, (2) technical reports of government agencies, universities, and industrial and independent research organizations in the United States and abroad, and (3) the book, patent, and journal literature, on a world-wide basis.

MANAGING EDITOR
John W. Norris

ASSISTANT MANAGING EDITOR
Donald D. Davis

ASSOCIATE EDITOR
Robert C. Kelly

PRODUCTION EDITOR
Lawrence T. Whitehead

TECHNICAL EDITOR
David E. Bost

INDEX EDITOR
Everett J. Hoffman

EVALUATORS
William D. Matheny
John H. Mitchell
Mary H. Newman
Lee M. Thompson

SUBJECT AUTHORITY EDITOR
Thomas R. Henley

CORPORATE AUTHORITY EDITOR
Clara L. Fox

ABSTRACTORS
D. Lamar Cason
Henry H. Dix
James R. Dulaney
Bernard O. Griggs
Mary Catherine Grissom
Phyllis Hansen
Thomas F. Heagerty
Carolyn D. Houston
Rose V. Jermain
Julia Redford
Ned W. Rizzardi
Anne G. Ward

EXCHANGES
Margaret L. Pflueger

SCHEDULING AND PUBLISHING COORDINATOR
Henry H. Lansford

Communication concerning the editorial policy and content of NSA should be addressed to the Managing Editor, NUCLEAR SCIENCE ABSTRACTS, AEC Division of Technical Information Extension, P.O. Box 62, Oak Ridge, Tennessee.

US.92 A8n
v.17 pt.2

ARRANGEMENT OF ABSTRACTS

Informative abstracts are arranged according to several categories and subcategories as illustrated by the Table of Contents. Author abstracts are frequently used. A single abstract is presented for a single report or article. In the case of comprehensive progress reports, or conference proceedings and symposia, an abstract is provided both for the whole publication and for each individual topic, section, or paper. The subject matter of the item abstracted determines the placement of an abstract into the category arrangement. In certain instances more than one category could be considered for an abstract. In such cases, the category which encompasses most of the subject matter of the item is selected, and "see" references are provided at other appropriate category headings.

INDEXES TO NSA

Regular Cumulations. Each issue of NSA includes indexes for personal author, corporate author (issuing organization), subject, and report number. These indexes are cumulated quarterly as Numbers 6B and 18B, semiannually as Number 12B, and annually as Number 24B. The entries in the report number index cite, when known, the sources through which the report is made available and, if appropriate, the price. Report numbers also appear in the personal author, subject, and corporate author indexes. The personal and corporate author indexes include "short titles" of the items indexed. The subject index consists of main headings that are generally names of specific materials or objects followed by modifiers that describe the properties of, and processes applied to, the subject of the main headings. Cross references ("see" and "see also" references) appear in the cumulative indexes. Index entries are arranged according to the word-by-word alphabetic system.

Multivolume Subject and Author Accumulations. A cumulated author and subject index covering Volumes 1 through 4 (July 1948–1950) is included in the bound Volume 4 which is available from the Johnson Reprint Corporation, 111 Fifth Ave., New York, N. Y. ($30.00). A subject and author index covering Volumes 5 through 10 (1951–1956) is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($5.25).

A cumulated index covering Volumes 11–15 (1957–1961) is available from the U. S. Government Printing Office, Washington 25, D. C., as follows: Subject Index ($19.00), Personal Author Index ($14.25), and Corporate Author Index ($2.50).

Cumulative Report Number Index. A report number index is issued annually that includes all reports contained in all volumes of NSA together with public availability citations. The Cumulative Report Number Index, Vols. 1–16, will be available from the U. S. Government Printing Office, Washington 25, D. C., ($4.50).

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Atomic Energy Commission reports is indicated in the Report Number Index. Also included, when known, is the availability of many reports of other government agencies and organizations, both in the United States and abroad.

The availability of certain unnumbered reports abstracted in NSA is included in the abstract. The abbreviation GPO indicates that the material is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Journal articles, books, and other published materials are available through standard commercial subscriptions or library sources.

Dissertations taken from DISSERTATION ABSTRACTS are available from University Microfilms, Inc., 315 N. First Street, Ann Arbor, Michigan.

Many of the published materials abstracted in NSA are deposited in the Library of the Oak Ridge Institute of Nuclear Studies (a USAEC Depository Library) and are available on interlibrary loan from that source.

TS

TABLE OF CONTENTS

Volume 17, Number 5, March 15, 1963

Category	Page
GENERAL AND MISCELLANEOUS	723
BIOLOGY AND MEDICINE	725
General and Miscellaneous	725
Biochemistry, Nutrition, and Toxicology	729
Fallout and Ecology	737
Radiation Effects on Living Tissues	739
Radiation Sickness	764
CHEMISTRY	770
General and Miscellaneous	770
Analytical Procedures	771
Inorganic and Physical Chemistry	781
Organic Chemistry	791
Radiation Chemistry and Radiochemistry	793
Raw Materials and Feed Materials	800
Separation Processes	801
ENGINEERING AND EQUIPMENT	805
General and Miscellaneous	805
Heat Transfer and Fluid Flow	807
Materials Testing	809
GEOLOGY, MINERALOGY, AND METEOROLOGY	811
HEALTH AND SAFETY	817
INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS	826
INSTRUMENTS AND INSTRUMENTATION	829
General and Miscellaneous	829
Radiation Detection	834
ISOTOPE SEPARATION	843
MATHEMATICS AND COMPUTERS	844
METALS, CERAMICS, AND OTHER MATERIALS	846
General and Miscellaneous	846
Corrosion	853
Fabrication	858
Properties and Structure	863
Radiation Effects	876
PHYSICS	883
General and Miscellaneous	883
Astrophysics and Cosmology	898
Cosmic Radiation	900
Criticality Studies	904
Elementary Particles and Radiations	904
Neutron Physics	917
Nuclear Properties and Reactions	919
Particle Accelerators	946
Plasma Physics and Thermonuclear Processes	958
Shielding	969
Theoretical Physics	970
REACTOR TECHNOLOGY	973
General and Miscellaneous	973
Power Reactors	982
Production Reactors	987
Research Reactors	987
SPACE APPLICATIONS AND TECHNOLOGY	989
WASTE DISPOSAL AND PROCESSING	991
CORPORATE AUTHOR INDEX	INDEX-1
PERSONAL AUTHOR INDEX	INDEX-11
SUBJECT INDEX	INDEX-50
REPORT NUMBER INDEX	INDEX-119

HOW TO OBTAIN NUCLEAR SCIENCE ABSTRACTS

Subscription. The semimonthly abstract issues and the four cumulated-index issues are available postpaid on subscription and in single copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at the prices indicated below:

- SEMIMONTHLY ISSUES. Annual subscription rate: $22.00, domestic; $27.50, foreign. Price per single copy: $1.25, domestic; 25 per cent extra for foreign mailing.
- CUMULATIVE-INDEX ISSUES. Annual Subscription rate: $22.00, domestic; $25.00, foreign. Price per single copy varies according to the number of pages. The Cumulative Report Number Index, Vols. 1–17, will also be available separately from the Superintendent of Documents, U. S. Government Printing Office, at a price to be announced later.
- DOMESTIC SUBSCRIPTION RATES apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.
- FOREIGN SUBSCRIPTION RATES apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Exchange. NSA is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

Availability to Government Agencies. NSA is available free of charge to U. S. Government Agencies upon request to the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

NOTE ON TRANSLATIONS

The literature of nuclear science and technology is abstracted and indexed in NUCLEAR SCIENCE ABSTRACTS where possible from the original language. Abstracts of translations appear in NSA only when the original material was not available. For translations of the original language material appearing in NSA into other languages, including English, such sources as: (1) "USAEC Translation Lists" and TID-4025 "Translation Title List and Cross Reference Guide" published by the Division of Technical Information, U. S. Atomic Energy Commission and (2) TECHNICAL TRANSLATIONS published by the Office of Technical Services, U. S. Department of Commerce should be consulted. Source (1) is available at all AEC domestic and foreign depositories. Source (2) is available on subscription from the Superintendent of Documents, U. S. Government Printing Office, annual subscription $12.00 ($4.00 additional for foreign mailing).

Legal Notice

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in these reports, or that the use of any information, apparatus, method, or process disclosed in these reports may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in these reports.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

Use of funds for printing this publication has been approved by the Bureau of the Budget, July 29, 1960.

Volume 17, Number 5 March 15, 1963

NUCLEAR SCIENCE ABSTRACTS

GENERAL AND MISCELLANEOUS

5654 (HW-SA-2502) OPTIMIZING PROGRAMMING EFFORT THROUGH MACHINE PROCESSING AND SCHEDULING. Ray E. Cain (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 22, 1962. Contract [AT(45-1)-1350]. 12p.

Average elapsed time from receipt to delivery of completed processing for test and debug passes on Fortran and 9PAC monitor work was reduced to less than two hours. This reduction was accomplished by a thorough review and revision of work methods, procedures, and operating and scheduling policies for debug work. (auth)

5655 (HW-SA-2546) PHYTOSOCIOLOGICAL ANALYSES IN A DESERT SHRUB COMMUNITY FOLLOWING ATOMIC EXPLOSIONS. W. H. Rickard (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 20, 1962. Contract AT(45-1)-1350. 7p.

Quantitative and qualitative changes were recorded in the annual vegetation when phytosociological comparisons were conducted between adjacent disturbed and undisturbed plant communities two and three years after the last occurrence of atomic explosions in target area 4, Yucca Flat, Nevada. (auth)

5656 (KR-29) QUARTERLY PROGRESS REPORT ON [KJELLER RESEARCH] APRIL–JUNE 1962. (Norway. Institutt for Atomenergi, Kjeller). Oct. 1962. 60p.

Research and development progress is reported on JEEP, NORA project, JEEPNIK, JEEP II, reactor dynamics, general physics, fuel element development, fuel reprocessing, and isotope production and development. Participation in the Netherlands-Norwegian Reactor School is described. (M.C.G.)

5657 (TID-3714) INFORMAL LISTING OF BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE. Bibliographies Issued or in Progress During the Period, October–November 1962. (Division of Technical Information Extension, AEC). 29p.

A total of 54 completed bibliographies and 81 bibliographies in preparation are cited. Indexes are provided for subjects, authors, and report numbers. (R.J.S.)

5658 (TID-16647) NUCLEAR EXPLOSIVES AS A POTENTIAL TECHNIQUE FOR IMPROVING WATER RESOURCES. [L. J. Vortman] (Sandia Corp., Albuquerque, N. Mex.). [Sept. 1962]. Contract [AT(29-1)-789]. 14p. (SCDC-2827)

The economics of using nuclear explosives for constructive purposes are compared to those for coal. Safety aspects of nuclear explosions are discussed. The formation and use of underground cavities are studied as a possible means for storing and transporting water. (R.J.S.)

5659 ENERGY NEEDS AND THE ROLE OF ATOMIC ENERGY IN THE FORATOM COUNTRIES. K. Schmidt-Amelung. Atomwirtschaft, 7: 438-9(Aug.-Sept. 1962). (In German)

A survey is given of the energy needs and sources of the FORATOM countries. The possible place of nuclear energy in each of these countries–West Germany, France, Belgium, Holland, Italy, Austria, Switzerland, and Spain–is considered. (J.S.R.)

5660 COMMENTS ON THE DEFINITION OF THE CURIE, WITH SPECIAL REFERENCE TO NATURAL RADIOACTIVE MATERIALS. R. G. Jaeger and H. Houtermans (International Atomic Energy Agency, Vienna). Intern. J. Appl. Radiation Isotopes, 13: 267-72(June 1962). (In English)

An analysis of maximum permissible levels of radionuclides showed that the definition of the curie, when applied to natural radioactive materials, is ambiguous. The history of the definition of the curie is reviewed. In the past, no clear distinction was made between the curie as a unit of the quantity of a radioactive substance, and the curie as a unit of radioactivity. This has caused different interpretation of the curie as applied to natural radioactive materials, e.g., natural uranium and natural thorium. A redefinition of the curie as a pure unit of radioactivity is suggested, and maximum permissible levels or concentrations of natural radioactive materials, such as uranium or thorium, should be stated in mass per unit mass or volume of air, water, food, etc. It is recommended that, in legislation listing the amounts of naturally occurring radioactive substances, these amounts be stated in milligrams or kilograms. (auth)

5661 NUCLEAR TRAINING IN WESTERN EUROPE. H. Adam (Staatliche Ingenieurschule, Kiel). Kerntechnik, 4: 587-92(Dec. 1962). (In German)

An introduction concerning the future work of physicists and engineers on all lines of nuclear technics is followed by a review of methods and aims of instruction in general engineering. After this several possible lines of nuclear instruction of engineers are shown. Six months or twelve months additional training following the graduation in general engineering is preferred. Night-schools are important for additional training of engineers working in industry. Training of engineers in engineering colleges is treated, and the training facilities of universities and research centers are named. The basic training directions and the existing training facilities of six European countries are shown by means of a schedule. (auth)

5662 HEARING BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED

STATES, EIGHTY-SEVENTH CONGRESS, SECOND SESSION ON PEACEFUL USES OF ATOMIC ENERGY. (United States. Congress. Joint Committee on Atomic Energy). April 10, 1962. 151p. $0.45 GPO.

Hearings on peaceful uses of atomic energy were held before the Joint Committee on Atomic Energy of the Congress of the United States on April 6, 1962. Dr. Glenn T. Seaborg, chairman of the Atomic Energy Commission, reviewed recent advances in the development of atomic energy for peaceful purposes. Emphasis was placed on the development of nuclear power plants for the production of electricity, applications of radiation in processing foods to increase storage life, applications of atomic energy in studies on fundamental particles and the basic properties of atomic nuclei, the development of radioisotope-fueled batteries for use in satellites and as sources of electrical power for remote arctic weather stations and light houses, and applications of radioisotopes in gages, in the production of luminous points, and in the diagnosis and treatment of diseases. Adm. Hyman Rickover discussed the development of atomic power with emphasis on uses in nuclear-powered submarines, aircraft carriers, and other marine craft. The potentialities of civilian atomic power were discussed with emphasis on the operation of the Shippingport power reactor. Educational aspects of atomic power as well as of all science, engineering, and the humanities were discussed. Comparisons were made between different national systems of education, with emphasis on the evaluation of U. S. and Russian educational systems. Pertinent publications are included. (C.H.)

5663 BIOCHEMICAL FUEL CELL POTENTIALITIES FOR SPACE FLIGHT. W. R. Scott (Magna Corp., Anaheim, Calif.), G. H. Rohrback, and M. G. del Duca. Preprint Paper No. 2562-62. New York, American Rocket Society, 1962. 16p. $1.00.

Paper from Space Power Systems Conference, Sept. 1962, Santa Monica, Calif.

An introduction of biochemical fuel cells is presented, including the special characteristics of these cells, useful types of catalysts, and mechanism of reactions. A number of bioelectrodes are discussed in detail with performance data. The general application of bioelectrochemical devices to space vehicle operation is considered, including disposal of solid, liquid, and gaseous human waste products. Present and future capabilities are discussed. The point is made that as a result of their low power density biochemical fuel cells do not appear promising as power supplies. They do become valuable when serving a dual purpose as an auxiliary power unit and as a chemical converter for closed ecological systems. An example is presented in the form of a concept of a system for creating a localized habitable environment in space. In this concept a solid material is converted to water, nitrogen, carbon dioxide, and ultimately to oxygen with the aid of a bioelectrochemical cell. (auth)

5664 NUCLEAR ENERGY IN BRITAIN. New York, British Information Services, 1962. 97p.

The development of peaceful uses of nuclear energy in Britain is reviewed, along with the organizations responsible for the development, the evolution of the nuclear power program, and the role of nuclear power in meeting Britain's energy requirements. Discussion is also given on radioisotopes and their uses, the part played by private industry in nuclear development, current nuclear research, and Britain's part in international nuclear co-operation. (P.C.H.)

5665 THE USE OF MATERIAL BALANCE INFORMATION. D. W. Hoba (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 21, 1962. 9p. (HW-SA-2761)

To be published in Proceedings of 1962 AEC-Contractors Nuclear Materials Management Meeting, held in Chicago, Ill., October 3-5, 1962.

A material balance area is a device utilizing measurement and accounting information so as to provide quantitative data on material received, removed, and in inventory. This factual procedure provides a sound basis for results evaluation and can be used for informed decisions by management. The material balance area concept is dependent on relevant factors of need, material value, process information requirements, or regulation compliance considerations. Effectiveness can be defined mathematically as the algebraic difference of (beginning inventory and receipts)–(ending inventory and removals). A zero difference is a very theoretical ideal. Seldom, if ever, is it achieved and even then more likely by designed manipulation. Both measurement limitations and the process requirements imposed on an operation's manager preclude a zero difference. How large the difference can be depends on its source. Regardless of how small or how large the variance, it is obvious that a procedure differentiating nonsignificant and significant differences would materially contribute to the decision for action. This phase of the problem is discussed and techniques for interpretation and as feedback for improvement purposes are provided. (auth)

BIOLOGY AND MEDICINE

General and Miscellaneous

5666 (AD-274294) STUDY OF THE USE OF MODELS TO SIMULATE DYNAMICALLY LOADED UNDERGROUND STRUCTURES. Final Report. Andrew A. Arentz, Jr. (American Machine and Foundry Co. Mechanics Research Div., Niles, Ill.). Feb. 1962. Contract AF29(601)-4374. 77p. (AFSWC-TDR-62-3)

The results are presented of an analytical investigation of the use of models to simulate dynamically loaded structures buried under the ground. Scaling laws were proposed relating the model structure and soil medium to the corresponding prototype components. Physical properties of some materials were presented as a guide in choosing possible model simulants and a method presented for simulating soils. This represents the initial effort toward a solution of the dynamic similitude problem. (auth)

5667 (BNL-5798) ANOXIC PROTECTION OF THE SMALL INTESTINE OF DOGS BY INTRA-ARTERIAL CATHETERIZATION. Morton M. Kligerman, Victor P. Bond, Barry T. Held, George Mather, and N. Nielsen (Yale Univ., New Haven. School of Medicine and Brookhaven National Lab., Upton, N. Y.). Nov. 7, 1961. Contract [AT(30-2)-Gen-16]. 9p.

Results of a pilot study with intra-arterial occlusion of the superior mesenteric artery suggest that survival from acute intestinal radiation syndrome is possible at dose levels usually lethal within five days. Should this prove to be true on further study homologous transplantation of bone marrow in animals so protected will be considered. (auth)

5668 (DASA-1263) SHOCK MITIGATION WITH LIGHTWEIGHT VERMICULITE CONCRETE. Richard Shield, Ervin S. Perry, E. A. Ripperger, and J. Neils Thompson (Texas. Univ., Austin. Structural Mechanics Research Lab.). Feb. 1962. Contract DA-49-146-XZ-028. 61p. (AD-274129)

The impact cushioning characteristics of lightweight vermiculite concrete are presented in the form of acceleration-time and stress-strain curves. Data are included which show the effect of impact velocity and material thickness on the cushioning properties. The measurement technique used is a variation of the one used at the drop-test facility for the determination of the properties of cushioning materials, the essential difference being that the force-sensing device, an accelerometer, is allowed to move. Also, impact energy is provided by a projectile fired from an air gun, instead of a freely falling mass. (auth)

5669 (LAMS-2780) BIOLOGICAL AND MEDICAL RESEARCH GROUP (H-4) OF THE HEALTH DIVISION ANNUAL REPORT, JULY 1961 THROUGH JUNE 1962. (Los Alamos Scientific Lab., Los Alamos). July 1962. Contract W-7405-eng-36. 317p.

Separate abstracts were prepared for 6 sections of this report. (C.H.)

5670 (LAMS-2780(p.17-84)) MAMMALIAN METABOLISM SECTION. (Los Alamos Scientific Lab., N. Mex.).

Whole-body counting techniques were used in studies on the metabolism of Ba^{133} in mice and rats following single oral administration, the retention of Sr^{85} in man during 160 days after the administration of a tracer dose, the effect of x irradiation on the uptake and retention of Sr^{85} in rats, the retention of chronically ingested Cs^{137} in dogs, the metabolism of Ru^{106} chloride in dogs, the retention of Zn^{65} in humans, the effects of Ca EDTA on I^{131} retention in rats, and the retention of Sr^{85} in normal and tetracycline-treated mice. Data are tabulated. Interest in Ba metabolism is a result of reports that it has metabolic properties similar to those of Sr and the possibility that Ba^{133} may be substituted for Sr^{85} in long-term metabolic studies. The turnover rate of Sr^{85} in bone was not affected by tetracycline treatment. The age of rats influenced the effects of Ca EDTA on I^{131} retention in rats. A list is included of publications during the period covered by this report. (C.H.)

5671 (LAMS-2780(p.85-129)) MAMMALIAN RADIOBIOLOGY SECTION. (Los Alamos Scientific Lab., N. Mex.).

A survey on mice exposed to x rays, using three different experimental methods, showed that methodology in LD_{50} studies will account for very little of the interlaboratory differences reported in $LD_{30/50}$ values. The $LD_{30/50}$ for mice exposed to 250 kvp x rays was determined to be 560 ± 9 rads and 206 ± 3 rads for exposure to fission neutrons. The biological effectiveness of fission neutrons compared to x rays was approximately 2.7. Data are tabulated on the mean accumulated dose and mean survival time for mice exposed continuously throughout life to Co^{60} γ rays at different dose rates. Results are presented from a preliminary study to test the influence of dose rate on the amount of irreparable biological damage in mice as measured by resistance to cold stress. A comparison was made of the survival time of preirradiated and nonirradiated mice exposed to continuous γ stress. Results show a general decrease in mean survival time with age. Analysis of the reproductive performance in mice from x-irradiated sires showed radioinduced genetic damage in the irradiated line and that at least a portion of the damage is of a recessive nature. Preliminary results are given from studies on the radiosensitivity to protracted γ irradiation of granddaughters from x-irradiated sires, and the comparative radiosensitivity of three lines of mice with different ancestral histories to fractionated doses and to single acute exposures to x radiation. (C.H.)

5672 (LAMS-2780(p.130-80)) LOW-LEVEL COUNTING SECTION. (Los Alamos Scientific Lab., N. Mex.).

Data are tabulated from whole-body measurements of K^{40} and Cs^{137} in human subjects and measurements of Cs^{137} in milk samples. Absorption of 0.2 and 0.6% of Sr^{85} in 24 hr is reported for human subjects following cutaneous application. Factors affecting the operation of the whole-body γ spectrometer are discussed and improvements are reported. Progress is reported in the fabrication of γ ray spectrometers for lunar surface γ measurements during Ranger spacecraft flights. Results are included from two unsuccessful Ranger flights. (C.H.)

5673 (LAMS-2780(p.181-210)) CLINICAL INVESTIGATIONS SECTION. (Los Alamos Scientific Lab., N. Mex.).

Clinical applications of whole-body counting reported include determinations of thyroid activity by measurement of retention of orally administered I^{131}, determinations of the retention of p-toluidine polyvinylpyrrolidone labeled with I^{131} as a measure of serum or blood loss, and tracer studies using Fe^{59} for a comparison of the absorbability of

ferrous versus ferric salts in normal human subjects. Electronically determined erythrocyte volumes for human and chicken blood were analyzed statistically for the distribution of subpopulations of cells. A possible mutation causing hydrocephaly was observed in the offspring of an irradiated line of male mice. (C.H.)

5674 (LAMS-2780(p.211-45)) CELLULAR RADIOBIOLOGY SECTION. (Los Alamos Scientific Lab., N. Mex.).

The calibration of an electronic particle counter for bacterial measurements is reported. Procedures are described that were used for the sterilization of components for lunar spectrometers. Preliminary attempts to obtain synchronous growth for E. coli B and Hemophilus influenzae are reported. Factors affecting the growth characteristics of HeLa cells in a fluid medium are discussed. Results are reported from a study on the differential sensitivity of HeLa cells to specific and nonspecific intranuclear tritium β irradiation. (C.H.)

5675 (LAMS-2780(p.246-317)) MOLECULAR RADIOBIOLOGY SECTION. (Los Alamos Scientific Lab., N. Mex.).

Procedures and results of nucleic acid chromatographic studies are discussed. A number of resins was screened for polynucleotide desorption properties. Data are tabulated. A positive-pressure gradient-elution device was evaluated for use to achieve precise control of column environment. Applications of thin-layer chromatography to nucleic acid chemistry are discussed, and results are tabulated from the tracer studies on the chromatographic separation of purine and pyrimidine bases and their desoxyribonucleosides. The reactions and results are described of studies directed at the preparation of aligouridylic-3' acids from uridine-3' phosphate derivatives in which the 2'-hydroxyl function is blocked. The aqueous-phenol system for extracting biologically intact desoxyribonucleic acid from mammalian sources was examined and the distribution of certain proteins and polypeptides in aqueous-phenol was studied. A modified method is described for the combustion and colorimetric analysis of submicrogram amounts of organic phosphorus. Fragments resulting from the radiolytic degradation of H^3-deoxycytidine in aqueous solution and of high specific activity H^3-thymidine were identified. Preliminary studies indicate that the use of quaternary ammonium derivatives of desoxyribonucleic acid to extend the application of countercurrent distribution in nucleic acid chemistry does not hold much promise. (C.H.)

5676 (SAM-TDR-62-99) A COMPARATIVE STUDY OF HUMAN AND MONKEY LEUKOCYTES IN CULTURE. Yasushi Ohnuki, Akio Awa, and C. M. Pomerat (Pasadena Foundation for Medical Research, Calif.). May 14, 1962. Contract AF41(657)-357. 7p.

To develop a satisfactory culture procedure for rhesus monkey (Macaca mulatta) leukocytes, several technical variations of the routine method were investigated. Those included in the present study were the use and the amount of different kinds of phytohemagglutinins, the separation of erythrocytes after preservation or centrifugation, sera derived from the horse, the calf, and the monkey for supplementing the culture medium, and the ratio of host serum containing leukocytes to the nutrient fluid. None of these factors gave satisfactory results for monkey samples, but all were useful for human cells. Such an unusual situation might possibly be caused by differences in the physicochemical and cellular properties of the blood of the monkey and of man. (auth)

5677 (TID-14613) CLINICAL USE OF THE ARM COUNTER IN BLOOD CLEARANCE STUDIES. C. C. Lushbaugh and R. L. Schuch (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 24p. (LADC-5102).

A scintillation detector and electronic circuits are described that were developed to measure radioactivity in the circulation of the arm. The arm counter has proved useful in studies of erythrocyte survival using Cr^{51} as a tracer, plasma Fe clearance using Fe^{59} as a tracer, plasma protein survival and intestinal fat absorption using I^{131} as a tracer, and Na retention using Na^{22} as a tracer. Possible applications in other clinical and diagnostic tests that require repeated isolated observations are discussed. The counter has also given good results when used as a whole-body counter for measuring small amounts of radiation in mice, rats, and other small animals. (C.H.)

5678 MINERAL METABOLISM OF FRACTURES OF THE TIBIA IN MAN STUDIED WITH EXTERNAL COUNTING OF Sr^{85}. Bo Wendberg (Univ. of Lund, Sweden). Acta Orthopaed. Scand., Suppl. 52: 79p.(1961). (In English)

A study was made of 51 adult patients with tibial fractures by external counting with scintillation detectors over the thighs, knees, and tibias during a 14-day period after intravenous injection of 25 to 50 μc Sr^{85}. The pattern of activity curves recorded over the fractured leg compared to those recorded over the control leg varied significantly with the age of the fracture (2 days to 9 yr). Increased uptake of Sr^{85} was observed in all cases. The activity ratio fracture/control tibia obtained 14 days after injection rose during the 1st months after fracture to reach a peak value 6 to 8 months after fracture. The mean 14-day fracture/control ratios obtained 5 to 10 months after fracture was 15.5 ± 7.2; then it dropped. Even 6 to 9 yr after fracture the counting rate over the fracture was higher than that over the intact tibia. No differences in activity uptake were observed between normally healing fractures and fractures showing delayed or nonunion. Activity curves obtained over the thigh, knee, and tibia of the fractured and intact legs 1 to 14 days after injection of Sr^{85} could be simulated on the basis of a 2-compartment model for the kinetics of Sr in the body. Based on this kinetic analysis the externally recorded Sr^{85} activity values may be interpreted as follows: The activity ratios fractured/intact leg obtained during early intervals after injection are mainly related to differences in the size of the exchangeable mineral spaces under the detector. The 14-day activity ratio of 2 anatomically comparable locations may be used as a relative index of the difference in the accretion rate (rate of irreversible deposition of bone mineral) in these locations, but is somewhat lower than the absolute difference in the accretion rate. The bone salt laid down in the fracture callus is derived from the body fluids. The accretion rate in the fracture region is increased within a week of the fracture. It rapidly increases during the first months after fracture to reach a peak value at 6 to 8 months after fracture. The accretion rate in the entire fractured leg is increased some months after fracture. The traumatic osteopenia is caused by increased resorption and not by decreased accretion. (H.H.D.)

5679 FURTHER STUDIES ON THE ACCUMULATION OF RADIOACTIVE COLLOIDAL GOLD IN INFLAMMATIONS. E. Ezer and L. Szporny (Gedeon Richter, Ltd., Budapest). Arch. Intern. Pharmacodyn., 138: 263-7(July 1, 1962).

The uptake of Au^{198} by subcutaneous absecesses produced by injections of dextran was studied in rats. When Au^{198} was injected intravenously at the same time dextran was

injected subcutaneously, radioactivity over the injected skin 15 min later was 4.2 times greater than that over control skin. When Au^{198} was injected 30 min after dextran and readings were taken 15 min later, the activity was only 2.5 times greater in injected than control skin. Subcutaneous injection of testicular hyaluronidase also increased the accumulation of Au^{198} in skin (4.7-fold) but only when it was given simultaneously or within 5 min of Au^{198} injection. The results indicate that the isotope is taken up at an early stage of the inflammatory process, probably because capillary permeability is maximal at this time. (H.H.D.)

5680 THE USE OF METAL COMPENSATORS TO CORRECT FOR TISSUE HETEROGENEITY IN RADIOTHERAPY WITH HIGH ENERGY RADIATION BEAMS. E. J. Hall and R. Oliver (Churchill Hospital, Oxford). Brit. J. Radiol., 35: 852-5(Dec. 1962).

A method is described for correcting the dose distribution beyond tissue inhomogeneities by means of a metal compensator mounted in the incident beam. The method is an extension of the one used to correct for irregular contours. Experiments are reported that confirm the accuracy of the technique. (auth)

5681 SMALL DOSES OF INTRA-ARTERIAL P^{32} IN LOCATION OF CEREBRAL TUMORS FOR BIOPSY. Lindsay Symon (National Inst. for Medical Research, Mill Hill, London). Brit. Med. J., 2: 94-6(July 1, 1961).

Brain tumors were successfully located by probe counting after an intra-arterial injection of 50 μc P^{32}. The pattern of uptake of various tumors was the same by this method as after intravenous injection of the isotope. Adequate uptake for tumor location was obtained only within the field of supply of the injected artery. The use of a dose of 50 μc by intra-arterial injection, one-tenth to one-twentieth of the dose suggested for intravenous use, avoided the necessity for isolation of the patient or special methods of urine disposal. It also greatly reduced the difficulty of handling the isotope in a neurosurgical unit where such material is used only occasionally. (H.H.D.)

5682 CANCER THERAPY: EVALUATION OF SUPERVOLTAGE X RAY—A REVIEW OF THE LITERATURE. Lewis G. Jacobs (Veterans Administration Hospital, Palo Alto, Calif.). Calif. Med., 97: 163-5(Sept. 1962).

Statistical evidence that indicates that cure rates achieved by supervoltage are not significantly different from those achieved by orthovoltage in carcinoma of the tonsil and of the ovary is presented. The higher depth dose of supervoltage therapy may produce severe damage to structures about the tumor, and the assumption that a greater number of cures will result because of dose increase must be balanced against the well documented fact that severe damage to the tumor bed lessens rather than increases the proportion of cures. To evaluate the relative benefits, 2 forms of cancer were selected for review. Cancer of the tonsil was chosen as an example of a relatively accessible tumor and cancer of the ovary as a deep seated tumor. A list was made of the number of cases treated, the number of 5-yr survivals, and the voltage range. The survey showed that the increased cost of supervoltage is not associated with better cure rates. (H.H.D.)

5683 TRANSPLANTATION OF MARROW AND WHOLE ORGANS: EXPERIENCES AND COMMENTS. E. Donnall Thomas and Joseph W. Ferrebee (Mary Imogene Bassett Hospital, Cooperstown, N. Y.). Can. Med. Assoc. J., 86: 435-44(Mar. 10, 1962).

Efforts to explore in large animals, and to extend to man, clinical implications derived from a large body of radiation studies in mice have met with partial success. Marrow function that has been destroyed by radiation exposure can be restored easily by intravenous infusion of viable autologous (isogeneic) marrow cells. Cells for these infusions can be stored at low temperature for prolonged periods. The transplantation of foreign (allogeneic) marrow is difficult and presupposes a careful destruction of the host's defence against foreign tissue. It requires also an adjustment of the successful graft's reaction against its defenceless recipient. Current investigations with chemicals that affect immune response offer encouragement to the hope that these problems of the transplantation of marrow and the somewhat similar problems of the transplantation of whole organs may be managed eventually in a manner that is clinically acceptable. (auth)

5684 WHOLE BODY SCANNING IN MEDICINE. I. PHYSICAL ASPECTS. R. G. Baker, A. D. Rotenberg, J. F. Cederlund, and H. E. Johns (Univ. of Toronto). Can. Med. Assoc. J., 87: 367-70(Aug. 25, 1962).

Physical aspects of scanning the human body to determine in vivo radioisotope distribution are discussed, with special reference to the importance of collimator design and data display system. The pertinent details of a sensitive whole-body scanner which has proved useful in clinical practice are described. The main features contributing to its versatility are: (1) fully automatic operation, (2) use of a 5-in. diameter detector crystal with a focusing collimator, (3) provision to scale the scintiscan presentation to a convenient size, and (4) photographic recording of the scan. The scanner was designed for locating primary and secondary tumors in which the preferential uptake of radioactive material may not be much greater than in surrounding tissues. The focusing collimator was constructed with 37 hexagonal tapered holes, which pack more efficiently than round holes for the same minimum wall thickness between holes and thus expose a greater surface area of the crystal. A whole body-scan with limited resolution (1 in. between successive traverses) or a restricted area scan with better resolution (down to $\frac{1}{4}$ in. between traverses) could be made well within a reasonable scanning time of the order of 45 min. The mechanical system moves the detector head in a horizontal plane beneath the patient. The head moves transversely, at a scanning rate which is adjustable from 0.1 to 1 in./sec. After a traverse, the head is automatically moved a step of $\frac{1}{4}$, $\frac{1}{2}$, or 1 in. longitudinally and the next traverse is initiated. (H.H.D.)

5685 RADIOISOTOPE SCANNING OF THE PRECORDIAL DISTRIBUTION OF IODIDE IN PATIENTS WITH MYOCARDIAL INFARCTION. Dean T. Mason, Robert L. Frye, and Henry N. Wagner, Jr. (Johns Hopkins Hospital, Baltimore). Circulation, 24: 1338-41(Dec. 1961).

The possibility of detecting myocardial infarction by a method employing I^{131} was investigated, since it was previously observed that I^{131} was selectively taken up by pulmonary infarcts. Precordial scans were made 24 hr after oral or intravenous administration of 100 to 200 μc NaI^{131} to 12 patients showing clinical or electrocardiographic evidence of myocardial infarction. Six of 12 patients had a ratio of 1.2 : 1.0 or greater when precordial isotope measurements over the left chest were compared with a corresponding position over the right chest. Although I^{131} appeared concentrated along the diaphragmatic border of the heart, the possibility that the radioactive material might be concentrated in the stomach was considered. Evidence obtained by comparing the concentration of radioactivity in a sample of gastric contents to that of simultaneous blood samples after intravenous I^{131} was ad-

ministered supported the concept that the radioiodine was concentrated in the stomach. Since saliva contains a high concentration of I^{131}, it is possible that swallowed saliva plays some role in the collection of radioiodine in the stomach; however, the stomach itself also can concentrate iodide. Since gastric emptying is delayed in immobilized patients, it was postulated that the enforced bed rest in patients with myocardial infarction would lead to a higher mean concentration of secreted I^{131} in the cardia of the stomach. (H.H.D.)

5686 ACTION OF STRONTIUM IONS ON THE ISOLATED HEART OF THE RAT AND GUINEA PIG. E. Corabouef, P. Guilbault, D. Breton, and M. Dumont (Faculté des Sciences, Paris). Compt. Rend. Soc. Biol., 155: 1251-7(Dec. 18, 1961).

Addition of 2.1 mM/l Sr^{++} (as $SrCl_2$) to the saline solution bathing rat heart progressively lowers the amplitude of contraction, to ~15% below normal within 10 min. This inhibition is preceded by a slight, transient stimulation of contraction. Inhibition is reversible if Sr^{++} is removed within 4 to 5 min. In guinea pig heart under the same conditions, Sr^{++} produces greater inhibition; amplitude is reduced 30% after 6 min., without a preliminary positive inotropic effect. If 90% of the Ca^{++} ions in the salt solution are replaced by Sr^{++}, Sr^{++} completely compensates for the lowering of Ca^{++} concentration, indicating that it is completely equivalent to Ca in promoting contractility of rat heart muscle. However, in guinea pig heart the tonotropic action of Sr^{++} was proportionally greater than that of Ca^{++}. Thus, at low Ca concentrations rat heart is more sensitive to Sr^{++} than guinea pig heart. In the absence of Ca^{++}, Sr^{++} stimulates contraction to such an extent in both species that the excessive tonus practically abolishes heart action. It appears that Sr^{++} cannot totally replace Ca^{++} in the cardiac contractile mechanism. (H.H.D.)

5687 POLYCYTHEMIA VERA. G. Stecher, H. Wolfers, and P. Nettesheim (Universität, Cologne). Deut. Med. Wochschr., 86: 1861-7; 1899-1904(1961).

The effects of P^{32} injections in 132 patients with polycythemia vera are described. P^{32} was given intravenously in doses of 3 to 8 mc in 120 cases, and later orally in doses of 5 mc in some cases. An average of 5.5 mc was required to normalize red cell levels; the yearly dose averaged 4.4 mc per patient. In half of the patients the remissions lasted for 12 months or longer. Larger than average doses were required to treat patients with marked splenomegaly and (or) very high leukocyte counts, and patients with long-lasting disease. No correlation was found between the P^{32} dose required to induce remission and other factors such as age, sex, and constitutional type. A given dose of P^{32} produced a greater fall in red cell count in patients with the highest initial count, and for patients with similar initial counts, the higher the dose the greater the fall in red cell level. In some cases, a correlation was found between the amount of P^{32} administered and duration of remission. Longer remissions were observed in patients who showed the sharpest fall in counts after P^{32} was given. In 11% of the cases there was an unusually marked but reversible depression in hematopoiesis after P^{32}. In the 8-yr follow-up period, 23 patients died, including 4 which developed acute myeloid leukemia, 2 chronic myeloid leukemia, and 3 osteomyelofibrosis. (H.H.D.)

5688 A PINHOLE CAMERA FOR RADIATION RESEARCH IN DENTISTRY. Albert G. Richards (Univ. of Michigan, Ann Arbor). J. Dental Res., 41: 29-40(Jan.-Feb. 1962).

The design and theory of a pinhole camera that produces simultaneously radiographs and photographs of any object which emits x radiation and reflects visible light are described. Such a camera is useful for radiation research in dentistry because both the patient and the x-ray apparatus emit x radiation and reflect visible light while the patient is examined with x rays. The factors controlling time of exposure, size, and sharpness of the image are presented mathematically. Photographs and radiographs that were produced simultaneously of dental subjects are illustrated. Satisfactory photographs were made with the pinhole camera with exposures ranging between 35 to 60 min. Radiographic exposures made with radiation generated with 90 kvp ranged between 1500 and 4500 ma-sec. (H.H.D.)

5689 ABSORPTION OF X RAYS IN PSORIATIC PARAKERATOTIC HORNY LAYERS. Gerd K. Steigleder and Wolfgang P. Raab (Columbia Univ., New York). J. Invest. Dermatol., 38: 299-304(May 1962).

Discussion is given on the absorption of soft x rays by normal human stratum corneum. Polarized light demonstrated that unusually bright birefringent fibers in the parakeratotic stratum corneum are seen in the zones with the highest degree of x-ray absorption. Microradiography indicated that the psoriatic parakeratosis is accompanied by disturbances of the entire biological system of the horny layer as well as keratinization itself. (H.H.D.)

5690 THE KINETICS FOR TWO-BREAK CHROMOSOME EXCHANGES. Sheldon Wolff (Oak Ridge National Lab., Tenn.). J. Theoret. Biol., 3: 304-14(Sept. 1962).

An equation has been formulated to describe the theoretically expected kinetics for two-hit chromosome exchanges whether detected genetically as translocations or cytologically as dicentrics and rings. Data from diverse biological systems have been found to fit the expected values computed from this equation without having to rely upon such explanations as the occurrence of a large amount of inviability appearing at high doses or a large linear component. (auth)

5691 ESTIMATION OF THE TOTAL-BODY LOAD OF CAESIUM-137 IN JAPANESE PEOPLE. Noboru Yamagata (Inst. of Public Health, Tokyo). Nature, 196: 284-5(Oct. 20, 1962).

Data are tabulated on estimates of total-body cesium in Japanese people during 1960, 1961, and 1962. Examination of the distribution of stable Cs in the human body and diet provided a simple means of estimation of the total-body load of Cs^{137} irrespective of K concentration or the Cs unit under equilibrium or near equilibrium conditions. Examination of the distribution of stable Cs in the human body revealed the ratios of Cs and K differ in various tissues. It is suggested that a correction factor must be used when estimates of Cs^{137} are based on K concentration. A means of estimation of the whole-body load of Cs^{137} is described in which a body weight of 56 kg is assumed as average for Japanese adults. The concentration of Cs^{137} in $\mu\mu c/g$ of fresh muscle is multiplied by 38 to give the total-body load in $m\mu c$. This method is practical for autopsy material. (C.H.)

5692 ELECTRON SPIN RESONANCE AND ITS APPLICATIONS. R. J. Cook and D. H. Whiffen (National Physical Lab., Teddington, Eng.). Phys. Med. Biol., 7: 277-300 (Dec. 1962).

The method of electron spin resonance spectroscopy for studying free radicals and related materials is outlined and the basic parts of the theory are given. Some typical spectrometers are indicated and details are given of the arrangement of samples of different kinds. Three systems

are discussed in some detail, namely the spectrum of a free radical in irradiated alanine, the semiquinone spectrum in solution, and the hemoglobin crystal structure problem. Reference is made to applications in biology and related fields; subjects of special importance include radiobiology, photosynthesis, enzymic oxidation, and nucleic acid complexes. (auth)

5693 ON THE NATURE OF THE OBSERVED DECOMPOSITION IN STORED CARRIER-FREE NaI^{131} SOLUTIONS. O. Eichler, M. Hoebel, and Chr. Weege (Universität, Heidelberg, Ger.). Z. Physiol. Chem., 327: 135-43 (1962).

To investigate the decomposition products formed in aqueous solutions of NaI^{131}, paper chromatography was carried out on solutions stored 7 days or longer. Solutions containing 0.2 mc/ml at pH 5.5 to 6.0 were stored under N_2 in the dark. The presence of iodate in stored solutions was detected, as well as its increase with the duration of storage. Ultraviolet irradiation in the presence of O_2 markedly increased the rate of iodate formation; iodate content increased 20-fold after 2-hr irradiation. Formation of iodate could also be demonstrated in NaI^{131} solutions after addition of NaOCl, which acts as an oxidizing agent. Several other chromatographic fractions were noted as oxidation products of NaI^{131} solutions stored in the dark, but these were not identified. (H.H.D.)

5694 ELECTROLYTE CONCENTRATIONS OF INTRA- AND EXTRACELLULAR COMPARTMENTS IN SOME INTERNAL DISEASES. K. Itahara, K. Ito, T. Tominaga, T. Jimbo, and T. Sato (Tohoku Univ., Sendai). IAEA Preprint SM-32/43. 15p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

It was reported at the 3rd Japan Conference on Radioisotopes in 1959 that the total body water (D_2O-space), extracellular fluid volume (mannitol-space), and total exchangeable sodium and potassium were measured in edematous and hypertensive patients. In this paper, sodium and potassium concentrations in extra- and intracellular fluids were examined using Na^{24} and K^{42} in patients with essential hypertension, primary aldosteronism, and periodic paralysis. (auth)

5695 YTTRIUM-90 NEEDLES IN INTERSTITIAL BETA-THERAPY. B. Pierquin, M. Montreuil, H. Beyer, J. Dutreix, D. Chassagne, P. Galle, and R. Jammes (Centre d'Études Nucléaires, Saclay, France). IAEA Preprint SM-32/45. 13p. (In French)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

Some therapeutic applications of interstitial beta-therapy using Y^{90} are discussed. The preparation and properties of stainless steel needles containing yttrium oxide cylinders are described. Dosimetry of the needles is calculated and it is concluded that the needles have many potential applications where irradiation must be carried out very close to radiosensitive tissue. (W.D.M.)

5696 THE USE OF COPPER-64 IN THE INVESTIGATION OF REACTION MECHANISMS OF ENZYMES, PARTICULARLY AS RELATED TO FOOD PROCESSING. J. C. Arthur, Jr. and T. A. McLemore (Southern Regional Research Lab., New Orleans). IAEA Preprint SM-32/49. 18p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The oxidative enzymes of plant tissues are often dormant or only slightly active during the resting state, becoming active on the injury of the tissue or on separation from the tissue. During food processing this results in an acceleration of the oxidation of the natural substrates and polymerization of the products, which discolor the tissue. Copper oxidases are the principal enzymes involved in catalyzing these reactions. The activation of the enzyme also leads to its reaction inactivation. One of the causes of the phenomenon of reaction inactivation is the decrease in the effective concentration of the enzyme, probably by the removal or binding of its metal prosthetic group copper. By using copper-64, in vitro, it was shown that, in a resting solution, cupric ion can complex and/or exchange with the copper of the enzyme and that, in oxidizing solutions, an additional amount of cupric ion can be complexed. Cu-o-quinone type complexes have higher formation constants than Cu-p-quinone type complexes. The amount of cupric ion complexed was decreased, if the ion was added to an oxidizing solution after the initiation of polymerization of the o-quinone type reaction products. The kinetics of the exchange and complexing processes for cupric ions with enzyme and reaction products are discussed mathematically. (auth)

5697 IL CESIO-137. BASI FISICHE E INDICAZIONI TERAPEUTICHE. (Cesium-137. Physical Characteristics and Therapeutic Indications.) G. Buzzi, C. Cortisone, and L. Franco. Turin, Edizioni Minerva Medica, 1961. 100p. L.1500.

5698 RADIATION RESEARCH AND RADIATION TREATMENT. VOLUME 2. 41st MEETING OF THE GERMAN ROENTGEN SOCIETY. REPORTS IN THE FIELDS OF RADIATION PHYSICS, RADIATION BIOLOGY, AND RADIATION THERAPY. H. Meyer and J. Becker, eds. Munich, Urban and Schwarzenberg, 1960. 252p. DM 38. [In German]

Biochemistry, Nutrition, and Toxicology

5699 (BNL-6503) METABOLISM OF FISSION PRODUCTS IN MAN: MARSHALLESE EXPERIENCE. S. H. Cohn (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 27p.

The medical study of the Marshallese accidentally exposed to local fallout in 1954 is unique in that, along with the study of the Japanese fishermen, it provides the only data existing on the metabolism of mixed fission products in a human population. Early diagnosis of the internal radioactive contamination was made by radiochemical analysis of the excreta of the exposed people and by radiochemical analysis of the tissues and excreta of animals simultaneously exposed. Initially, Sr^{89}, Ba^{140}, I^{131} and its shorter-lived daughters and a number of rare-earth elements contributed the major portion of the internal radiation dose. After a year, the principal radioisotopes were Sr^{90}, Cs^{137}, and Zn^{65}. Subsequently these radionuclides and, more recently, Co^{60} as well, have been measured periodically. Since 1958 the gamma spectra of a number of Marshallese have been obtained with a whole-body counter. The findings of these studies for the past eight years are

discussed. The results of an early attempt to alter the rate of removal of the mixed fission products in the Marshallese with Ca-disodium EDTA are presented. The metabolism of the radionuclides and their relationship to levels present in the environment is also discussed. (auth)

5700 (HW-74969) REPRODUCTIVE PERFORMANCE OF MINIATURE SWINE INGESTING STRONTIUM-90 DAILY. R. O. McClellan, M. E. Kerr, and L. K. Bustad (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 20, 1962. 12p.

Female miniature swine comparable in size to man have been maintained on levels of daily Sr^{90} ingestion from 1 to 3100 μc per day. Animals fed up to 625 μc Sr^{90} per day during gestation and animals in levels up to 125 μc/day from conception through their reproductive cycle have given birth to normal sized litters of viable offspring of normal morphology. At the 3100 μc Sr^{90} per day level, the females died from radiation effects before parturition, but normal appearing fetuses were present. (auth)

5701 (HW-SA-2255) EFFECT OF CHRONIC FEEDING OF $Sr^{90}-Y^{90}$ ON RAINBOW TROUT. R. E. Nakatani and R. F. Foster (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [nd]. Contract AT(45-1)-1350. 14p.

The approximate quantity of orally administered $Sr^{90}-Y^{90}$ required to produce radiation damage and the syndrome involved in yearling rainbow trout was determined. Growth depressions and significant mortalities were observed when trout were fed 0.5 uc $Sr^{90}-Y^{90}$/g fish daily for 21 weeks, but two other groups of lower treatment levels of 0.05 uc and 0.005 uc $Sr^{90}-Y^{90}$/g fish did not differ from the control. A pronounced leukopenia was observed for the high level treatment group at the end of the test. The growth in weight of all groups with the exception of the high group was described as exponential growth during the 21 weeks. About 25 per cent of the administered dose was retained in all treatment groups. The total body burden of a 309 g trout in the high group was in the order of 2200 μc. At the end of the test no obvious damage was observed in low and medium groups; however, six months post-treatment leukopenia was indicated in the medium group. Clinically observed effects for the high group were anorexia, weight loss, listlessness, and a diminished response to external stimuli. (auth)

5702 (HW-SA-2848) ACCUMULATION OF RADIONUCLIDES BY AQUATIC INSECTS. J. J. Davis (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Nov. 29, 1962]. Contract AT(45-1)-1350. 13p.

A survey was made on the accumulation of radionuclides by aquatic insects in the section of the Columbia River that is within the Hanford Reservation in southeastern Washington. More than 60 different radioisotopes have been identified in the aqueous effluents that are continuously discharged into the Columbia River from some of the Hanford Reactors. About 20 of them have been measured in river organisms. Insects living in the river below the reactor outfalls were found to be many times more radioactive than the water they inhabit. The most abundant radionuclides in insects were P^{32}, Cu^{64}, Cr^{51}, Zn^{65}, and Na^{24}. Interspecies differences in radionuclides accumulation are influenced by ecological and metabolic factors. The most important factors influencing radionuclide accumulation by different species were found to be food habits, biological half-lives of the elements, and seasonal variation in feeding. Typical accumulation factor patterns are presented for a number of immature and adult aquatic insects and also for plankton. (C.H.)

5703 (TID-12729) CORRELATION OF URANIUM ALPHA SURFACE CONTAMINATION, AIR-BORNE CONCENTRATIONS, AND URINARY EXCRETION RATES. N. B. Schultz and A. F. Becher (Oak Ridge Gaseous Diffusion Plant, Tenn.). May 9, 1961. Contract [W-7405-eng-26]. 15p.

A statistical evaluation is presented of field data including measurements of alpha activity on work surfaces, in the environmental air; and the results of urinalyses obtained from employees assigned to a UF_6 manufacturing facility. Two years are studied wherein personnel were subject to relatively low concentrations of both soluble and insoluble normal uranium compounds. Approximately 700 urine specimens were collected and 500 spot-air samples, 4000 shift-length air samples, and 24 surface surveys were made. Statistical correlations of these data are presented, and a method is proposed for estimating the exposure potential of employee groups working in environments having varying uranium concentrations. (auth)

5704 (TID-12790) IN VIVO GAMMA SPECTROMETRY FOR INHALATIONS OF NEPTUNIUM-237— PROTACTINIUM-233, COBALT-60, AND ZIRCONIUM-95— NIOBIUM-95. R. E. Cofield (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.). May 15, 1961. Contract [W-7405-eng-26]. 35p.

Techniques, calibrations, and efficiencies are reported for the measurement of the amount of three radioisotope systems in the human lungs. The measurement technology for $Np^{237}-Pa^{233}$, Co^{60}, and $Zr^{95}-Nb^{95}$ inhalations is based on in vivo gamma spectrometry with a large NaI scintillation detector in a low background counting chamber. The minimum detectable amounts are 0.00026 μc Np^{237} in equilibrium with Pa^{233}, 0.0006 μc Co^{60}, and 0.001 μc of Zr^{95} or Nb^{95} or Zr^{95} + Nb^{95}. These levels of detection are all less than 2% of the amount of the radionuclides which would deliver 0.3 rem/week to the lungs. Data from repetitive measurements on actual inhalation cases are presented for Co^{60} and $Zr^{95}-Nb^{95}$. (auth)

5705 (TID-14604) STUDIES ON Ra^{226}, Po^{210} AND Th^{228} IN BOVINE BONES AND TEETH. Elvira R. Di Ferrante (Argonne National Lab., Ill.). Oct. 1961. Contract [W-31-109-eng-38]. 18p. (UAC-5720)

Bovine jaw bones with teeth were analyzed for Ra^{226} and Po^{210}. An average ratio close to unity for the concentration of the two radioelements in bone and teeth formed after weaning age, suggests that estimates of body burden could be based on tooth analyses. Differences were noticed between the Ra^{226} contents of bone ash of different animals such as pigs, cows, and deer. The radium concentration in the ash of a pregnant cow was found to be three times that of its fetus, whereas a ratio of thirty was obtained for a porcine sample. In bovine bones the range of values found in the Th^{228} concentration was much smaller than that of Ra^{226} and Po^{210}. (auth)

5706 (TID-14893) LONG TERM EFFECTS OF THERAPEUTIC REMOVAL OF INTERNALLY DEPOSITED PLUTONIUM. Marcia W. Rosenthal (Argonne National Lab., Ill.). Dec. 1961. Contract [W-31-109-eng-38]. 8p. (UAC-5893)

Mice given 2.6 μc/kg of a polymeric form of Pu for 1 to 12 days were treated once a day with an intraperitoneal injection of Ca DTPA. The mice were allowed to live until moribund when they were sacrificed and autopsied and roentgenograms were taken of their skeletons. Other mice

were used as controls. The amount of Pu in the bone was reduced by about one-half and that of liver by about one-third in mice receiving DTPA therapy for 12 days. Bone tumor incidence was also reduced by one-half. The survival of the Pu-poisoned mice was significantly increased by DTPA therapy. (C.H.)

5707 (TID-15308) THE TRANSLOCATION OF THORIUM DAUGHTERS TO THE SKELETON OF THOROTRAST PATIENTS. L. D. Marinelli and H. F. Lucas, Jr. (Argonne National Lab., Ill.). Jan. 1962. Contract W-31-109-eng-38. 2p. (UAC-6011)

The thorium dioxide from Thorotrast injections is largely confined to the liver and spleen where most of the lesions also occur. Owing, however, to the translocation of the Th^{232} daughters, radioactivity is spread to the skeleton and other tissues. The radiation dose from the skeletal deposit depends on the amount of Thorotrast injected and may be several orders of magnitude higher than that normally obtained from natural internal emitters. Thorotrast patients represent an unusual, irreplaceable opportunity to study the effects of chronic radiation on man. Measurements were made of the Th^{232}, Ra^{228} and Th^{228} content of bone of patients. Extrapolating to the whole skeleton and correcting for the state of radioactive equilibrium in the liver and spleen, a good correlation is obtained between measurement and theory. From measurements to date, the Ra^{228} content is in accord with known retention of Ra^{226} in humans. No excess of Th^{228} was found in bone to justify the previous assumption that wash out Th^{228} is translocated from the R.E.S. to bone mineral. (auth)

5708 (JPRS-15871) THE ROLE OF METABOLISM OF FISH IN THE ACCUMULATION OF RADIOISOTOPES BY THEM. M. M. Telitchenko. Translated from Nauchn. Dokl. Vysshei Shkoly, Biol. Nauki, No. 3, 90-3(1962). 7p.

Factors affecting the accumulation of Sr^{90} by fish were investigated in Carassius carassius maintained in aquaria after the addition of Sr^{90}. The effects of temperature, light, oxygen, and metabolic state were investigated. Results indicate that Sr^{90} is taken up by fish not only with food but, to a lesser extent, through the gills. Higher temperature and light intensity increased metabolism and food intake that resulted in increased radioactivity. (C.H.)

5709 CONTINUOUS SCINTILLATION COUNTING OF CARBON-14 AND TRITIUM IN EFFLUENT OF THE AUTOMATIC AMINO ACID ANALYZER. Karl A. Piez (National Inst. of Health, Bethesda, Md.). Anal. Biochem., 4: 444-58(Dec. 1962).

The construction of a quartz cell containing crystalline anthracene for continuous determination of carbon-14 and tritium in the effluent of the amino acid analyzer is described. The cell can be used with standard scintillation counters permitting efficiencies of 38% at 18 cpm background or 27% at 7 cpm background for C^{14} and 0.9 and 0.7% with the same backgrounds for tritium. Depending on the choice of instrumentation the results can be indicated by a rate meter and recorder, or they can be simultaneously printed on tape and indicated on the recorder of the amino acid analyzer. Carbon-14 and tritium can be determined in the same experiment in different amino acid peaks or, with the use of two channels in the conventional manner, in the same peak. A C^{14} activity of about 1000 dpm can be determined with a 5% standard error. Above 3000 dpm the error is 1–3%. About forty-fold higher activities are required for tritium. (auth)

5710 SEPARATION OF LABELED FROM UNLABELED PROTEINS BY EQUILIBRIUM DENSITY GRADIENT SEDIMENTATION. A. S. L. Hu, R. M. Bock, and H. O. Halvorson (Univ. of Wisconsin, Madison). Anal. Biochem., 4: 489-504(Dec. 1962).

The theory of equilibrium density gradient sedimentation was examined and experiments were performed to determine experimental conditions that would give high resolution between two proteins differing 1 to 4% in density. The parameters examined for their effect on resolution and on the time needed for effective resolution were: density difference between labeled and unlabeled proteins, molecular weight of protein, sedimentation path length, centrifugal field, and the equilibrium density distribution given by various solvents. The enzyme β-galactosidase was labeled with deuterium, N^{15}, and C^{13}. It is shown that the method will resolve labeled and unlabeled proteins if an adequate, but attainable, density difference has been introduced. (P.C.H.)

5711 A RADIOISOTOPE METHOD FOR STUDYING CEREBRAL CIRCULATION. Stephen W. Thompson. Arch. Neurol., 5: 580-9(Dec. 1961).

Time concentration curves, made with intravenously injected radioactive tracer and an externally placed detector over the head, were investigated as a method for evaluation of regional cerebral circulation. This concept can be utilized to obtain comparable values in different subjects proportional to monitored cerebral circulating blood volume. In 25 normal subjects between age 24 and 55, the values varied slightly, the mean value being 20 and the standard deviation 0.633. Normal subjects over 55 had lower and more variable values than the younger group, the mean value being 16.8 and the standard deviation 2.49. Lower values may reflect the tendency to decreased brain vascularity in the older age group. Inhalation of 5% CO_2 in O_2 produced no significant change in the values in normal subjects. However, Valsalva's maneuver produced a significant increase in normal subjects, and coughing produced the same change to a greater degree in 1 subject with cough syncope. Two of 12 patients with cerebrovascular disease had had intracerebral hemorrhages and gave significantly low values. The remaining 10 had cerebral arteriosclerosis resulting either in transient ischemic attacks or infarction. Their values did not vary significantly from those of normal subjects of similar age. Two patients with cerebral arteriovenous anomalies had high peaked curves, unique in shape and different from all the other curves. The procedure appears to be a relatively simple, innocuous way of ruling in or out the presence of cerebral arteriovenous anomalies in suspected cases. (H.H.D.)

5712 MOVEMENT OF STRONTIUM IN THE HUMAN BODY. T. E. F. Carr, G. E. Harrison, J. F. Loutit, and Alice Sutton (Medical Research Council. Radiobiological Research Unit, Harwell, Berks, Eng.). Brit. Med. J., 2: 855(Sept. 29, 1962).

Data which supplement previous deductions are given on the rate of replacement of bone Sr in normal adults. A previous conclusion that total turnover of skeletal Sr is 10 times that of replacement could not be substantiated. Heparin used for the collection of plasma was found to be contaminated with stable Sr, giving an erroneously low specific activity for plasma. (H.H.D.)

5713 INFLUENCE OF INCREASED POTASSIUM INTAKE ON THE EXCRETION OF RADIOACTIVE CESIUM (Cs^{137}) IN HUMANS. K. G. McNeill, R. G. Green, and A. Rapoport (Univ. of Toronto). Can. Med. Assoc. J., 85: 1377-80(Dec. 23, 1961).

In 5 healthy human adults without history of radioactive contamination, 2.5 g K was fed daily in an attempt to in-

crease urinary excretion of Cs^{137}. No long-term effect of K ingestion on Cs^{137} excretion was noted, the mean daily output of Cs^{137} being 46 and 45 $\mu\mu c$ during K-feeding and control periods, respectively. Na excretion was unaffected by K ingestion. Estimates were made of the total K and Cs^{137} ingested daily by one of the subjects in the long-term experiment during the base-line period when no extra K was taken. The estimated levels were 3.1 g K and 50 $\mu\mu c$ Cs^{137} per day, in excellent agreement with the measured excretion values of these materials. It thus appears that raising the K content of a person's diet above its normal level will not wash out the amounts of Cs^{137} normally present in the body, nor will it effect the output of Na. (H.H.D.)

5714 THE DETERMINATION OF RADIOSTRONTIUM IN HUMAN TISSUE. F. J. Bryant. Chem. Ind. (London), 1228(July 7, 1962).

Determination of Sr^{90} in human bone ash involves the separation of about 10^{-13} g of Sr^{90} from up to 20 g of Ca. To achieve this, 25 mg of Sr carrier were added and the Ca was preferentially removed by repeated treatments with strong nitric acid. After radiochemical purification the Sr was precipitated as carbonate and the yield determined by weighing. Sources were counted, after a period of 14 days, in special β counters (background 0.5–1.0 cpm). If Sr^{89} is present, erroneously high results will be obtained by direct counting and in such cases the Sr^{90} content can be determined by separating and counting the Y^{90} daughter. When the activity level is low, this is not practicable and the courses are recounted after 6–8 weeks and the decay is assumed to be due to Sr^{89}. The mean level of Sr^{90} varied with the age of the subject, the highest values being found in the 0–5 yr age group and the lowest in adults. Also, within age groups there were significant differences from year to year. Thus the values for stillbirths and the 0–5 yr group show maxima which occurred in 1959 for the former and 6 months later in the latter group. This is shown clearly when results are broken down into narrower age groups. For subjects up to the age of 4–5 yr there was negligible variation in the Sr^{90} content between bones but in adults marked differences were observed. (H.H.D.)

5715 THE METABOLISM OF STRONTIUM-90 IN BONE. J. F. Loutit (Medical Research Council, Harwell, Berks, Eng.). Chem. Ind. (London), 1228-9(July 7, 1962).

From the specific activity of plasma, during 1 week after intravenous injection of Ca^{45} into man, it was calculated that about $^1/_7$ of the injected dose remained in bone at 1 yr. About $^1/_5$ of dietary Sr (2 mg/day) was absorbed, therefore daily apposition was 0.06 mg Sr/day, which is equivalent to about 5% replacement of skeletal bone per year. The specific activities (Sr^{90}/Sr) of various bones from 11 normal subjects (accidental deaths) were obtained in 1959. From specific activities of diet, observed 1958 and 1959 and estimated for earlier years, the rate of deplacement of bone salt by new salt of dietary origin can be calculated, if the process be assumed random. The observed specific activities corresponded to 1%/yr for compact bone and up to 8%/yr for vertebral spongy bone. Children in the growth phase present greater difficulties in interpretation. It was concluded that adolescence involves mainly accretion of additional bone. Data for 1960–61, yet incomplete, suggest that bone salt is reutilized preferentially to salts of recent dietary origin. (H.H.D.)

5716 RETENTION OF RADIOACTIVE TRACERS IN DRY ASHING OF BLOOD. C. E. Gleit and W. D. Holland (Tracerlab, Inc., Richmond, Calif.). Intern. J. Appl. Radiation Isotopes, 13: 307-8(June 1962). (In English)

An alternate method of decomposing organic material utilizes a stream of oxygen excited by an electrical discharge. The effects of the oxygen method on the loss of tracers from blood were studied and compared with those of conventional dry ashing. The results for the oxygen method show that Sb, As, Cr, Co, Fe, Cu, Pb, Mn, Mo, and Zn are quantitatively retained in the combustion boat, but that Au, Hg, and Ag were partially volatilized. However, the three volatilized elements were redeposited within the glass system and could be recovered by rinsing the inside with mineral acids. Preliminary experiments indicate that the oxygen method is applicable to other biological materials. (D.L.C.)

5717 TREATMENT OF RADIOSTRONTIUM INTOXICATION IN MICE. I. THE ENHANCEMENT OF ELIMINATION OF RADIOSTRONTIUM. L. M. van Putten (Radiobiological Inst. of the Organization for Health Research T.N.O., Rijswijk (Z. H.), Netherlands). Intern. J. Radiation Biol., 5: 471-6(Sept. 1962). (In English)

Attempts were made by various treatments to reduce the retention of radiostrontium after a single injection in mice. Treatment was started 48 hours after injection to obtain a true elimination of the isotope instead of a prevention of its deposition. Optimal results were obtained by feeding the mice a phosphorus-deficient diet. After six weeks on this diet the radiostrontium retention was reduced by 30 to 50% in comparison with control mice. (auth)

5718 TREATMENT OF RADIOSTRONTIUM INTOXICATION IN MICE. II. SURVIVAL AND BONE-TUMOUR FREQUENCY. L. M. van Putten (Radiobiological Inst. of the Organization for Health Research T.N.O., Rijswijk (Z.H.), Netherlands). Intern. J. Radiation Biol., 5: 477-84 (Sept. 1962). (In English)

The feeding of a phosphorus-deficient diet to mice starting two days after injection of Sr^{90}, significantly reduced bone-tumor frequency and increased survival-time. Evaluation of the relation of total radiation dose and of dose-rate to tumor frequency suggests that dose-rate is not the major determinant of bone-tumor incidence. The interpretation is compatible with an indirect carcinogenesis by radiation through primary tissue damage. No conclusions can be drawn about the practical applicability of this treatment to accidental Sr^{90} intoxication in man. (auth)

5719 PHYSIOLOGICAL EFFECTS OF TRITIATED WATER ON RHODOTORULA GRACILIS AS INFLUENCED BY CYSTAMINE. G. Giovannozzi-Sermanni, R. Masironi, and I. Cacciari (Univ. of Rome). Intern. J. Radiation Biol., 5: 485-91(Sept. 1962). (In English)

The effects of tritium-emitted beta-radiations were tested on the germination time, the period of lag, the cellular permeability, and the respiratory quotient of Rh. gracilis treated with tritiated water in the presence of different concentrations of cystamine. In our experimental conditions, cystamine at the metabolically-inactive concentration 2.5×10^{-4} M showed no radioprotective activity on the cells, while at the metabolically-active concentration 2.5×10^{-2} M cystamine was capable of counteracting the effects of beta-rays. The cellular permeability remained unchanged in every treatment. The radioprotective action therefore seems to depend on the metabolic alterations brought about by the radioprotectant itself. (auth)

5720 AUTORADIOGRAPHIC STUDY OF DNA SYNTHESIS AND THE CELL CYCLE IN SPERMATOGONIA AND SPERMATOCYTES OF MOUSE TESTIS USING TRITIATED THYMIDINE. Valerio Monesi (Oak Ridge National

Lab., Tenn. and Comitato Nazionale per l'Energia Nucleare, Frascati, Rome). J. Cell Biol., 14: 1-18(1962).

Mice were injected intraperitoneally with 15 μc of H^3-thymidine. The time course of the labeling in spermatogonia and spermatocytes was studied by using autoradiography on 5 μ sections stained by the periodic acid-Schiff method and hematoxylin over a period of 57 hours after injection. Four generations of type A (called AI, AII, AIII, and AIV), one of intermediate, and one of type B spermatogonia occur in one cycle of the seminiferous epithelium. The average life span is about the same in all spermatogonia, i.e., about 27 to 30.5 hours. The average pre-DNA synthetic time, including the mitotic stages from metaphase through telophase and the portion of interphase preceding DNA synthesis, is also not very different, ranging between 7.5 and 10.5 hours. A remarkable difference exists, however, in the duration of DNA synthesis and of the post-DNA synthetic period. The average DNA synthetic time is very long and is highly variable in type B (14.5 hours), a little shorter and less variable in intermediate (12.5 hours) and AIV (13 hours) spermatogonia, and much shorter and very constant in AIII (8 hours), AII and AI (7 to 7.5 hours) spermatogonia. Conversely, the average post-DNA synthetic time, corresponding essentially to the duration of the prophase, is short and very constant in type B (4.5 hours), longer and variable in intermediate (6 hours) and AIV (8 hours) spermatogonia, and much longer and much more variable in AIII (11 hours), AII and AI (14 hours) spermatogonia. The premeiotic synthesis of DNA takes place in primary spermatocytes during the resting phase and terminates just before the visible onset of the meiotic prophase. Its average duration is 14 hours. No further synthesis of DNA takes place in later stages of spermatogenesis. (auth)

5721 EFFECT OF MILD HYPERTHYROIDISM UPON SECRETION OF I^{131} IN MILK OF DAIRY CATTLE. B. N. Premachandra and C. W. Turner (Univ. of Missouri, Columbia). J. Dairy Sci., 44: 2035-9(Nov. 1961).

Lactating dairy cows were administered 100 μC I^{131} intrajugularly, and samples of milk were analyzed daily for 5 days. During the 1st 24 hr 4.9 to 7.2% of the injected dose of I^{131} appeared in the milk, with a mean of 5.8%. During the 5-day period, the total mean percentage of the injected dose increased to 8.2, with a range of 6.9 to 9.2%. The tests were in the same cows during treatment with thyroxine equal to 50% more than the individual winter thyroxine secretion rate. Although daily milk secretion increased 22%, the mean percentage of injected I^{131} appearing in milk during the 1st 24 hr was reduced to 2.9, with a range of 1.9 to 3.9%. The mean total percentage of I^{131} appearing in milk during 5 days was 4.8, with a range of 3.4 to 6.0%. Decline in I^{131} in the milk followed an exponential course in both experiments. Mild hyperthyroidism thus reduced the I^{131} secretion in milk 50% the first 24 hr, and 41% during the 5-day period. Thus dairy cattle transferred relatively small amounts of I^{131} to their milk and this amount was further reduced by mild hyperthyroidism. (H.H.D.)

5722 SIGNIFICANCE OF PLASMA ULTRAFILTRABLE Ca^{45} AND P^{32} IN MILK SYNTHESIS. T. H. Kamal and R. G. Cragle (Univ. of Tennessee Atomic Energy Commission Agricultural Research Lab., Oak Ridge). J. Dairy Sci., 45: 43-7(Jan. 1962).

Jersey cows were injected intravenously with Ca^{45} and P^{32} simultaneously, and the ultrafiltrable as well as total Ca^{45} and P^{32} in milk and plasma were determined periodically to study the importance of these fractions in the formation of milk Ca and P. While most of the plasma P^{32} (85%) was still ultrafiltrable 1 hr after injection, the activity appeared in both fractions of milk, indicating that plasma ultrafiltrable P is the precursor of milk P. After the first 5 hr, the specific activity of plasma nonultrafiltrable P^{32} began to rise, whereas that of ultrafiltrable P^{32} continued to decline, and 43 hr were required for the ratio of plasma ultrafiltrable P^{32}/total P^{32} to reach a value (0.40) close to that of stable P (0.34). One hour after injection, 66% of the plasma total Ca^{45} was nonultrafiltrable, and presumably protein-bound. Partitioning of Ca^{45} in milk took place also within 1 hr and the maximum concentration of milk ultrafiltrable Ca^{45} coincided in time (3-5 hr) with that of nonultrafiltrable Ca^{45}, suggesting that plasma ultrafiltrable Ca is the precursor of milk Ca. Milk ultrafiltrable/total Ca^{45} and P^{32} fell to values close to those of stable Ca and P between the 3rd and 5th hr, which is the time required for the complete conversion of plasma Ca and P into all fractions of milk Ca and P. These results imply that the time required for incorporation of plasma Ca and P into all Ca and P-containing phases of milk is from 3 to 5 hr, which agrees with earlier work in intact animals, but not with in vitro experiments where 5 to 8 hr were required. (H.H.D.)

5723 EFFECT OF CHANGES IN FORAGE RATION ON THE THYROIDAL I^{131} RELEASE RATES OF YOUNG DAIRY ANIMALS. J. H. Vandersall, J. W. Hibbs, and H. R. Conrad (Ohio Agricultural Experiment Station, Wooster). J. Dairy Sci., 45: 218-22(Feb. 1962).

Thyroidal I^{131} release rates of Holstein heifers were significantly higher shortly after they were changed to legume-grass silage than when they were fed alfalfa hay. They were also significantly higher when the heifers were fed legume-grass silage from a plastic-covered stack or mixed grass-clover-alfalfa hay than when they were fed legume-grass silage from a tower silo. When the forage was changed from alfalfa hay to legume-grass silage, during the time I^{131} release rate was being determined, 3 of 5 calves exhibited an increased release rate, whereas their controls showed no change. When neutrilization of iodine was blocked with thiouracil, the 2 calves switched to silage showed a significant increase in I^{131} release rate, whereas 1 control calf exhibited a decrease and the other an increase. The changes in I^{131} release rate indicated that some as yet unidentified factor(s) in certain forages exerts an influence on the thyroid activity, so that an adjustment in thyroid activity of the animal is induced when a sudden change in forage rations is made. This may explain the sharp decline in milk production caused by ration changes noted previously. (H.H.D.)

5724 INTRACELLULAR LOCALIZATION AND QUANTITATION OF TRITIATED ANTIGENS IN RETICULOENDOTHELIAL TISSUES OF MICE DURING SECONDARY AND HYPERIMMUNE RESPONSES. Audrey N. Roberts and Felix Haurowitz (Indiana Univ., Bloomington). J. Exptl. Med., 116: 407-22(Oct. 1962).

H^3-aniline and H^3-arsanilic acid were diazotized and coupled to protein (porcine gamma globulin (PGG)), to form heavily substituted antigens. The intracellular localization of these H^3-antigens in cells of spleen, liver, lung, and lymph node was studied with autoradiography techniques. The autoradiographic findings were correlated to radiochemical measurements of H^3 in tissue sections using the windowless flow counter and 2 methods of scintillation counting. The surface activities of the intact tissue sections and the total activities of dissolved tissue sections were determined. An attempt was made to correlate sites of H^3-antigen deposition as determined, with autoradiography, to

DETROIT PUBLIC LIBRARY

sites of antibody synthesis, detected with fluorescence microscopy. Autoradiography revealed intracytoplasmic localization of grains in macrophages of spleen and lung, and in Kupffer cells of liver following intravenous and subcutaneous injections of H^3-aniline azo PGG. Quantitation of tissue section surface radioactivities in the windowless flow counter and scintillation counter, and of dissolved tissue section activities in the scintillation counter, showed that greatest radioactivity was present in lung tissue, with less in spleen, liver, and mesenteric lymph nodes from these hyperimmunized mice. Autoradiographic studies on tissue sections from mice in secondary response stimulation after subcutaneous foot-pad injections of H^3-arsanilazo PGG, showed intracellular and extracellular grains over regional popliteal node sections, with intracytoplasmic grain localization over macrophages and pyroninophilic plasmacytes. Scattered macrophages in spleen and lung sections also contained intracytoplasmic radioactivity. Clusters of antibody-synthesizing cells in the regional lymph nodes were demonstrated with fluorescence microscopy, and these cells were compared to similar cells possessing radioactivity as observed in the section autoradiographs. An occasional Russell body plasma cell containing specific antibody was observed in splenic impressions. Windowless flow counting showed that greatest radioactivity was in regional node sections, with less in spleen and lung, and none in contralateral lymph nodes. The results support the role of the macrophase in antigen uptake and their transfer of antigen to antibody-synthesizing cells. An attempt was made to correlate the grains produced in autoradiographs to the counts determined with the windowless gas flow counter per 5 μ section in a unit time. The resulting ratio of counts/grain using spleen, lung, and popliteal node sections was found to be ~20. Since 3.5×10^{-1} μg of H^3-arsanilazo PGG yielded 756 cpm, 20 cpm equaled $\sim 9.3 \times 10^{-3}$ μg of the radioactive antigen. Therefore, each exposed grain represented the minimum presence of 9.3×10^{-3} μg of H^3-antigen in the upper 1 μ of a tissue section surface. (H.H.D.)

5725 OBSERVATIONS ON PERSONNEL WORKING WITH FLUORINE AT OAK RIDGE GASEOUS DIFFUSION PLANT. J. S. Lyon (Oak Ridge Gaseous Diffusion Plant, Tenn.). J. Occupational Med., 4: 199-201(Apr. 1962). (TID-13996)

No impairment of the health was noted in individuals working in fluoride concentrations considerably in excess of 0.1 ppm. Sixty-one persons were exposed over an 8-year period. (C.H.)

5726 THE EVALUATION OF THE RATES OF BIOLOGICAL PROCESSES FROM TRACER KINETIC DATA. I. THE INFLUENCE OF LABILE METABOLIC POOLS. Arthur L. Koch (Univ. of Florida, Gainesville). J. Theoret. Biol., 3: 283-303(Sept. 1962).

The effects of small, metabolically labile, intermediate pools on kinetics of isotope uptake and release are presented. The primary influence of such pools is to effect a coupling between components that are both derived and synthesized from the pool. Probably the most significant interaction is that of a component with itself. This is called recycling. It is shown that no matter how an isotope experiment is conducted, the true turnover rate or true half-life cannot be calculated without information additional to the time course of activity in the component under study. It is noted that the presence of the pool does not alter the shape of kinetic curves. Therefore, the existence of such a pool cannot be adduced from kinetic experiments, and consequently the interpretation of the observed rate constant or the equivalent half life as either a true value or an apparent value is equivocal. Methods to evaluate the true turnover rates are considered. When two components are both connected to the same small pool, the turnover of one influences the other. The conditions determining whether this interaction is significant are discussed. Such coupling adds an additional term to, and changes the rate constants of, the original equation. If there are many components, there are many additional terms. It is shown that under certain conditions, the terms due to components other than the one under study may be combined in a way to give great simplification. Finally, the influence of growth on tracer kinetics is considered. A treatment employing specific activity data, yielding the turnover rate constant for synthesis is presented. This treatment is nearly correct for systems changing by a limited factor, say less than two fold. A procedure employing total activity measurement which yields the turnover rate constant for degradation is also presented. (auth)

5727 THE DISTRIBUTION OF CALCIUM IN THE EPIPHYSEAL CARTILAGE OF THE RAT TIBIA MEASURED WITH THE ELECTRON PROBE X-RAY MICROANALYZER. E. J. Brooks, A. J. Tousimis, and L. S. Birks (Naval Research Lab., Washington, D. C.). J. Ultrastruct. Res., 7: 56-60(Aug. 1962).

A description is given of the electron probe x-ray microanalyzer used to determine the Ca distribution in the epiphyseal plate of the rat tibia. Vacuum-coating of the specimen with a thin layer of Al was added to the usual techniques for preparing thin section of biological specimens. Ca content was found to change from about 30 to 0% from the completely calcified cartilage edge toward the maturation zone of the epiphyseal plate. Variation in the concentration gradient may be related to the nonuniform distribution of hydroxyapatite crystals in the matrix collagen. (H.H.D.)

5728 I-125, A NEW RADIOISOTOPE FOR THE LABELED HIPPURAN RENOGRAM. Chester C. Winter and William G. Myers (Ohio State Univ., Columbus). J. Urol., 88: 100-2(July 1962).

Hippuran-I^{125} is recommended as the best agent for making radioisotope renograms. Its long half-life of 60 days is convenient, and it emits low-energy 27.2-35.4-kev photons that are inherently directional because about half of them are absorbed by the all-or-none photoelectric process. They are readily absorbed by brass, steel, or thin lead foils. This makes it simple to shield against them and to achieve effective collimation of them by much lighter and less bulky apparatus than is required with I^{131}. The soft I^{125} photons are absorbed efficiently in thin-crystal scintillation detectors that have much lower background counting rates than those used previously for making renograms with hippuran-I^{131}. I^{125} does not emit useless and undesirable β-particles; consequently, the photon merit ratio (usable photons/absorbed energy) is high. Radiation exposures to the patient are lowered when I^{125} replaces I^{131}. Risk of decomposition due to self-irradiation of photon carrier compounds is decreased when I^{125} is used to label them. (H.H.D.)

5729 CONCENTRATION OF STRONTIUM AT PREDILECTIVE SITES OF BONE TUMORS. William A. Sybers, Joseph F. Kuzma, and Gloria E. Zander-Principati (Marquette Univ., Milwaukee). Lab. Invest., 11: 727-31(Sept. 1962).

Studies were made of the tissue distribution of Sr^{89} after intraperitoneal injection of carrier-free Sr^{89} in a carcinogenic dose (2.5 μc/g) in various strains of mice (CF_1 and

Sprague-Dawley). Attempts were made to correlate Sr^{89} localization with tumor sites by assays of ashed bone radioactivity up to 4 months after the injections. The relative radioactivity over a period of 120 days increased in proximal femur and skull, decreased in distal femur and proximal tibia, and did not change in the lumbar and sacral vertebrae. No direct relation between relative specific activity of any bone (at any sacrifice period) and the incidence of osteogenic sarcoma in it was noted. High values of relative activity are most consistently found in the lumbar spine, yet this area has a tumor incidence of less than 10%. The skull at 120 days has the greatest relative concentration, but develops only a few tumors, and these primarily in the jaws. The proximity of dental tissue, which has the highest initial Sr^{89} concentration, contributes additive irradiation to jaw bone tissue, and renders this area different from all other parts of the skull. Whether an animal given Sr^{89} develops bone tumors depends primarily upon administered dose, dose retained, dose absorbed, and dose rate. Local factors of susceptibility or resistance to tumor development overshadow the radioactivity burden and appear to be more intimately associated with differences in local metabolic processes. (H.H.D.)

5730 ABSORPTION, EXCRETION, AND RETENTION OF STRONTIUM BY BREAST-FED AND BOTTLE-FED BABIES. C. L. Comar (Cornell Univ., Ithaca, N. Y.). Lancet, 1: 950-1(Apr. 29, 1961).

Criticisms are advanced against previous conclusions that breast-fed infants will lose most of the stable and radioactive Sr present in their skeletons at birth. It is suggested rather that the Sr/Ca ratio in the baby will reach a steady state and will always reflect the Sr/Ca ratio in the diet. A model is proposed as an alternative and as a more realistic extrapolation of observations. (H.H.D.)

5731 METABOLISM OF CALCIUM, STRONTIUM, AND OTHER MINERALS IN THE PERINATAL PERIOD. Elsie M. Widdowson, R. A. McCance, G. E. Harrison, and Alice Sutton (Cambridge Univ., Eng.). Lancet, 2: 373-4 (Aug. 25, 1962).

Amniotic fluid, urine formed in utero and passed at the time of birth, and meconium and urine passed during the 24 hr of fasting immediately after birth, were analyzed for Ca, Mg, Sr, P, Na, and K. Most of the minerals were at a higher concentration in amniotic fluid than in fetal urine. Sr was not, and the Sr/Ca ratio was higher in fetal urine than in amniotic fluid. During the 24 hr after birth, the concentration of Sr in urine increased but that of Ca did not; reabsorption in the renal tubules is therefore even more strongly in favor of Ca over Sr than it was before birth. Meconium contained higher concentrations of all the minerals than fetal urine, and the Sr/Ca ratio was much higher than in amniotic fluid. This suggests that Ca was preferentially absorbed by the fetal gastrointestinal tract. The mean Sr content of the various media were as follows: amniotic fluid 3.9 μg/100 ml, urine passed in utero 4.6 μg/100 ml, meconium 274 μg/100 g or 40.9 μg/kg body weight/24 hr, and urine passed the 1st day 15.2 μg/100 ml or 1.74 μg/kg/24 hr. The mean ratios of Sr × 10^3/Ca were: amniotic fluid 0.6, in utero urine 0.9, meconium 5.9, and 1st day postpartum urine 3.2. If Ca and Sr compete for biological transport mechanisms at all ages, before as well as after birth, so that Ca is preferentially transferred across the placenta, absorbed from the gut, reabsorbed in the renal tubules, and deposited in the bones, then this would explain the high Sr/Ca ratios in meconium, in urine formed just before and just after birth, and in urine of breast-fed babies receiving food with a low Sr/Ca ratio. (H.H.D.)

5732 DOUBLE COLLIMATOR ISOTOPE DETECTION FOR STUDY OF CAROTID BLOOD FLOW: A PRELIMINARY REPORT. D. W. Lindner, A. I. King, H. R. Lissner, and E. S. Gurdjian (Wayne State Univ., Detroit). Neurology, 11: 1042-9(Dec. 1961).

A method for measuring blood flow in the 2 carotid arteries in the neck or the 1 carotid pre- and postoperatively was investigated by the use of a specially designed double collimator for gamma rays. When the 2 detectors are placed along the carotid artery at a known distance, the arrival of a radioactive substance at each detector will give off a peak signal. A peak-to-peak signal in the known distance between the points of collimation may be used to indicate the velocity of flow. The method was tested in dogs with I^{131}-labeled serum albumin. A large detector with a NaI crystal 3-in. in diameter was used with the collimation head, which was designed to take the place of 2 detectors. A double lead cone collimator which focuses on 2 points $2\frac{3}{8}$ in. apart and $4\frac{1}{2}$ in. below the surface of the crystal was designed. The collimation was affected by molding lead so as to produce 2 annular air spaces in the form of half cones, skewed so that they came together toward the surface of the crystal. When the isotope passes under the 1st cone of the collimator, the count increases, pulses occurring at shorter time intervals. As it passes under the 2nd cone, a similar curve is obtained with the exception that there is a time delay, the time the isotope takes to travel from one point to the next. Albumin-I^{131} appeared to remain for a time in the blood stream as discrete globules, which added to the accuracy of the measurement by allowing for a whole series of measurements to be made within a very short time interval. The average computed flow from multiple readings was always within 4.3% of the actual measured flow. (H.H.D.)

5733 A METHOD OF LOW ENERGY GAMMA-RAY SPECTROMETRY APPLICABLE TO THE MEASUREMENT OF BIOLOGICAL SAMPLES. R. P. Parker (Royal Cancer Hospital, London). Phys. Med. Biol., 7: 301-11(Dec. 1962).

The measurement of the U^{238} and Th^{232} series by γ-spectrometry in the energy range 20–250 kev is considered. Following a description of the NaI (Tl) γ spectrometer, the physical properties of the nuclides involved are tabulated and measurements of certain standard spectra reported. The technique is illustrated by measurements of the uranium and thorium series, together with Cs^{137} and Ce^{144}, present in certain biological samples. Applications of the method are discussed. (auth)

5734 THE MEASUREMENT OF GAMMA-EMITTING ISOTOPES IN FAECES. W. F. Clapham and C. J. Hayter (St. Thomas' Hospital, London). Phys. Med. Biol., 7: 313-17(Dec. 1962).

A scintillation counter is described suitable for the assay of total fecal specimens. Sensitivities are given and are compared with those of a ring of Geiger counters and with those of a conventional sodium-iodide well counter. The assay of mixed isotopes by difference of gamma energy is described. (auth)

5735 THE CALCULATION OF ABSORBED TISSUE DOSES FROM ARSENIC-72. P. C. R. Turner (Hammersmith Hospital, London). Phys. Med. Biol., 7: 329-34 (Dec. 1962).

Absorbed radiation doses delivered to the whole-body, kidney, and liver by intravenous injections of As^{72} in humans were calculated and compared with the doses from As^{74}. It is shown that for a given limiting dose to the kidney the use of As^{72} permits lower whole-body doses and yields larger coincidence counting rates. (auth)

5736 SODIUM ACTIVATION BY FAST NEUTRONS IN MAN PHANTOMS. J. W. Smith (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Med. Biol., 7: 341-51(Dec. 1962).

Measurements were made of the activation, by fast neutron irradiations, of a dilute aqueous solution of sodium nitrate contained in man phantoms. Phantom shapes included a cylinder 30 cm in diameter, a slab 30 cm thick and an approximately man-shaped phantom. Monoenergetic neutrons were used, at energies of 0.2, 0.5, 2.5, and 6.2 Mev. From the measurements the neutron capture probability in a man may be determined for use in dose assessment after a criticality accident. A representative value of about 0.4 was obtained. The results for neutron capture, derived from sodium activation for both cylinder and slab, were compared with other values. (auth)

5737 GASTROINTESTINAL ABSORPTION OF Mg^{28} IN SHEEP. A. D. Care and D. B. Ross (Animal Health Trust, Farm Livestock Research Centre, Stock, Essex, Eng.). Proc. Nutr. Soc., 21: X-XI(1962).

A decrease in plasma Mg level accompanied a change in diet from hay to young grass in a crossbred wether sheep. The minimum plasma Mg concentration was usually reached ~24 to 36 hr after the dietary change; later, it gradually increased again to the normal range. Tracer quantities of Mg^{28} as $MgCl_2$ were introduced via a fistula to label the rumenal contents of a sheep fed each diet in turn. From the radioactivity of feces the proportion of Mg^{28} absorbed under each dietary regime was estimated by a method which minimized errors introduced by resecretion of Mg^{28} into the digestive tract. In this way the average percentage efficiency of absorption of rumenal $MgCl_2$ from the digestive tract was measured. Its value for the hay diet was $16.6 \pm 0.1\%$ and for the grass diet was $10.0 \pm 0.5\%$. This marked difference in efficiency of absorption suggests that hypomagnesemia is not caused by the presence in young grass of a high proportion of Mg which is bound so strongly that it cannot be released during digestion. The decrease in efficiency of absorption of ionic Mg is presumably the result of processes taking place in parts of the alimentary tract by which either the permeability of the intestinal wall to Mg^{2+} is reduced or the concentration of Mg^{2+} within the lumen is diminished. (H.H.D.)

5738 A METHOD FOR FORCE-FEEDING RADIOISOTOPES TO YEARLING TROUT. R. E. Nakatani (General Electric Co., Richland, Wash.). Progressive Fish Culturist, 24: No. 2, 56-9(1962). (HW-SA-2303)

A method is described for force-feeding of $Sr^{90}-Y^{90}$ to yearling trout. While the method was developed specifically for oral administration of small volumes of radioisotopes to trout, it can also serve as a useful technique for administering other types of test materials. (C.H.)

5739 THE PROBLEM OF THE RATIONAL APPLICATION OF COMPLEXONS FOR ACCELERATING THE ELIMINATION OF RADIOACTIVE ISOTOPES (Ce^{144}). N. O. Razumovskii, O. L. Torchinskaya, V. S. Balabukha, and V. F. Ushakova. Radiobiologiya, 2: 773-9(1962). (In Russian)

Experiments were carried out for determining the optimum dosage for reducing the Y and Ce content of the soft tissue by administering diethylene triamino pentaacetic acid (DTPA) and 2,2'-diamine diethyl ester of N, N, N', N'-tetraacetic acid (DEETA). Ce^{144} chloride was intraperitoneally injected into male white rats at a rate of 0.1 microcurie per gram of body weight; complexons were introduced in a similar manner in the form of Na–Ca salts. It was found that an increase of the amount of the injected complexon results in a lowering of Ce^{144} content of the organs. The effect is not additive, –subsequent injections were less effective than the first one. It was also shown that the DTPA and the DEETA should not be administered daily but on a less frequent schedule to avoid reduction of the effectiveness of the complexons. Further tests with labeled complexons are needed to clarify the question of the prolonged increase in the excretion of Ce^{144} following the injection of the complexons, as was noted by others in the case of Y^{91} and Pu^{239}. (TTT)

5740 CATTLE AND SHEEP THYROID ACTIVITY SHOWING AN ABNORMAL DECAY. F. Barreira (Laboratorio de Fisica da Commisao de Estudos da Energia Nuclear, Lisbon) and J. Amaral Mendes. Rev. Cien. Vet., 54: 15-20(Jan.-Mar. 1959). (In English)

Measurements were made of the radioactivity of a large number of thyroid glands from cattle and sheep from different regions of Portugal. Results are summarized. Radioactivity present had a half-life of about 11 days, which is greater than the half-life of I^{131}. The activities measured were too low for the identification of radionuclides. (C.H.)

5741 DETERMINATION OF RADIOSTRONTIUM IN BONE. I. DISTRIBUTION IN SKELETON OF SHEEP. F. Barreira (Laboratório de Fisica da Commisão de Estudos de Energia Nuclear, Lisbon), J. Amaral Mendes, and Elina M. Neves. Rev. Cien. Vet., 55: 282-4(Oct.-Dec. 1960). (In Portuguese)

An evaluation of Sr^{90} content in several bones of a sheep skeleton was made to obtain information on the distribution of this radionuclide and to see to what extent individual samples are representative. The results show that the radiostrontium content is not uniform in spite of some regularity. (auth)

5742 CALCIUM-47 IN THE STUDY OF BONE PHYSIOLOGY AND PATHOLOGY. R. A. Guérin. Rev. Rhumat., 29: 338-41(June 1962).

The use of Ca^{45}, Ca^{47}, Ga^{67}, and Sr^{85} in the study of Ca metabolism of bone in human subjects is discussed. Ca^{47} is considered to be most suitable because of its short half-life (~5 days) and high specific activity (10 mc/mg for $Ca^{47}Cl_2$). Studies were conducted in 28 patients injected intravenously with Ca^{47}; uptake in various bones was followed by external scintillometry for periods up to 11 days later. In healthy subjects the distribution of activity was symmetrical, with highest uptake in sternum and manubrium and lower uptake in cranium (particularly the occipital region), clavicle, and iliac crest. Epiphyses of the long bones showed less avidity for Ca^{47}, that in tibia being highest. Sternum fixed 2 to $2\frac{1}{2}$ more Ca^{47} than the upper tibial epiphysis. This indicates that in the normal adult more Ca is taken up by spongy than compact bone. The Ca^{47} content of bone increased rapidly, reaching a plateau by the 5th or 6th day in most bones and by the 10th day in some, such as clavicle. Studies in pathologic cases showed the very high, but transient, uptake by callus in fractures and an uptake in Paget's disease of bone that was 3 times normal. Higher than normal uptake was also noted in bone lesions in lymphogranulomatosis, where osteogenesis compensating for increased bone destruction could be detected. Pathologic states could also be detected by following the disappearance of Ca^{47} from plasma, it being delayed by hypercalcemia associated with multiple cancer metastases in bone or accelerated by hypocalcemia, such as in Paget's disease. The rate of urinary excretion of radioactivity was also of diagnostic value. (H.H.D.)

5743 A SURVEY AND ASSESSMENT OF THE METHOD OF THYROID I^{131} UPTAKE. H. Kakei, I. Watanabe, N. Ari-

mizu, and K. Saegusa (Chiba Univ., Japan). Saishin Igaku, 16: No. 3, 692-8(1961).

A survey of thyroid I^{131} uptake with a high uptake manikin (uptake 57%) in 36 laboratories revealed correct values of 57 ± 9% in 55%. Use of the normal uptake manikin (uptake 33%) in 38 laboratories gave correct values of 33 ± 5% in 53 and 36%, corresponding to 24 and 50 ml of thyroid volumes, respectively. The largest factor influencing the results was the phantom A filter. The use of a flat field collimator with a wide visual field, a medical spectrometer, and a phantom yielding a similar spectrum to that from the neck is recommended. A side window type G-M tube increased the sensitivity. (Abstr. Japan Med., 2: No. 9, Sept. 1962.)

5744 STUDY ON PROTECTION OF INTERNAL CONTAMINATION BY RADIOACTIVE STRONTIUM. T. Ukita and J. Uchiyama (Tokyo Univ.). Tohoku Hyg. Chem., 7: No. 2, 168(1960).

After injection of 0.1 μC of Sr^{90}, mice were given food containing 20 mg of aluminum citrate per 2 g of food. Sixty % of the Sr^{90} given was excreted within the first 24 hr, and 70% within 6 days. In the control animals, only 45% was excreted within 6 days. Aluminum citrate is considered to be one of the most effective accelerators for excretion of Sr^{90} from the body. (Abstr. Japan Med., 2: No. 9, Sept. 1962)

5745 THE EFFECT OF VARIOUS DIETARY LEVELS OF PROTEIN (CASEIN) ON THE INCORPORATION OF STRONTIUM: EXPERIMENTS WITH STABLE STRONTIUM. L. Kállai, S. Dobos, and R. Tarján (Hungarian Academy of Sciences, Budapest). Z. Physiol. Chem., 326: 162-5(1961).

Bone fractures were produced in adult rats which were fed a diet containing 1.5% $SrCO_3$ and varying concentrations of protein. Casein was added to the basal diet to give protein contents of 12, 18, or 25%. After 28 days the Sr content of bone rose to more than 100 times that in the bone of animals not fed Sr. The Sr content of bone in rats fed 12, 18, and 25% protein was 0.31, 0.28, and 0.26%, respectively. Thus, at the 2 higher protein levels the incorporation of Sr in bone was significantly decreased. Ca content in the 3 groups (21.9, 21.9, 23.0, respectively) did not differ significantly. The ratio of Sr × 1000/Ca for the 3 groups was 14.4, 12.9, and 11.2, the last 2 values being significantly lower than the 1st. It is concluded that a high-protein diet depresses incorporation of Sr in bone mineral. (H.H.D.)

5746 WHOLE-BODY-COUNTER STUDIES OF THE ABSORPTION AND TURNOVER OF IRON AND VITAMIN B_{12}. P. G. Reizenstein, D. C. Price, S. H. Cohn, E. P. Cronkite, and L. R. Wasserman (Brookhaven National Lab., Upton, N. Y.). 4p. of "Proceedings of the Eighth Congress of the European Society of Haematology." New York, S. Karger, 1962. (BNL-6352)

A method is described to measure B_{12}-absorption with a whole-body-counter using a double-tracer technique. Quantitative absorption data for free and intrinsic-factor-bound B_{12} are obtained in a single test which is easy to perform on an out-patient basis. Iron absorption was measured in a similar manner. Iron deficient patients absorbed more than non-iron-deficient. The relation of iron absorption to serum iron, iron binding capacity, mean cellular hemoglobin and previous phlebotomies was shown. Iron turnover data indicated a more rapid excretion than previous studies with the fecal excretion method or hemoglobin iron method had indicated. Iron deficient patients excreted radioiron more slowly than non-iron-deficient. The implications of tracer radioiron turnover on that of cold iron in the body stores and on iron requirements were discussed. (auth)

5747 ANNOTATED BIBLIOGRAPHY OF STRONTIUM AND CALCIUM METABOLISM IN MAN AND ANIMALS. C. L. Comar and R. H. Wasserman (Cornell Univ., Ithaca, N. Y.). USDA Publication No. 821. [Washington, D. C., Department of Agriculture], 1961.

5748 SPRAVOCHNIK PO TOKSIKOLOGII RADIOAKTIVNYKH IZOTOPOV. (Handbook on Toxicology of Radioisotopes). D. I. Zakutinskii, Yu. D. Parfenov, and L. N. Selivanov. Moscow, State Publishing House on Medical Literature, 1962.

Systematized data and tables are given on the toxicology of radioactive materials. An analysis is made of physical and chemical properties of radioactive elements and of their exchange properties in animal and human organisms. Basic formulas are given for calculating permissible doses in air, open waters, and laboratories. (R.V.J.)

Fallout and Ecology

5749 (CDRP-182-113) RESULTS OF COMPUTATIONS MADE FOR DASA-USNRDL FALLOUT SYMPOSIUM. R. Read, L. Wagner, E. Moorehead, and R. Moriarty (California. Univ., Berkeley. Inst. of Engineering Research). Nov. 1962. Contract CD-SR-58-40. 78p.

The regression techniques introduced by the Civil Defense Research Project for estimating fallout particle deposition coordinates, their standard ellipses, and isointensity contours have been applied to some of the homework problems assigned for the DASA-USNRDL Fallout Symposium. The results are reported and the estimates are contrasted with estimates based on the assumption that winds are invariant with time. (auth)

5750 (DXRL-F6) FALLOUT IN NEW ZEALAND. Quarterly Report, July through September 1962. (New Zealand. Dominion X-Ray and Radium Lab., Christchurch). 11p.

Weekly collection of rain samples from Funafuti, Western Samoa, and Rarotonga is being continued. Land and sea food samples are also being obtained at a reduced rate from the Tokelau Islands, Penrhyn, Western Samoa, and Rarotonga. The results of measurements on these samples are not yet available. In New Zealand, new rain collecting stations have been established at Kaitaia, New Plymouth, and Dunedin. Collection at these stations commenced on July 1, 1962. Monthly Sr^{89} and Sr^{90} depositions at these stations are given. The present network of New Zealand collecting stations for rain, soil, and milk samples is shown. (R.J.S.)

5751 (HASL-132) FALLOUT PROGRAM QUARTERLY SUMMARY REPORT, SEPTEMBER 1, 1962 THROUGH DECEMBER 1, 1962. Edward P. Hardy, Jr., Joseph Rivera, and William R. Collins, Jr. (New York Operations Office. Health and Safety Lab., AEC). Jan. 1, 1963. 259p.

Current data are presented from the HASL Fallout Program, the U. S. Naval Research Lab., the New Zealand Department of Scientific and Industrial Research, and the Dominion X-Ray and Radium Lab. in New Zealand. Radionuclide levels in fallout, milk, tap water and upper air samples are given in tabular form. Interpretive reports and notes dealing with Sr^{90} and stable Sr levels in diet and human bone, fallout at a single gummed film station, Sr^{90} in 1961 wheat, Cs^{137} to Sr^{90} ratios in fallout, and the calculated residence times for Cd^{109} tracer are included. A

bibliography of recent literature pertinent to fallout studies is given at the end of the report. (auth)

5752 (HW-SA-2337) CESIUM-137 IN DRIED MILK PRODUCTS IN RELATION TO NATURAL VEGETATION ZONES. W. H. Rickard, Jr., A. D. Wiggins, and J. K. Fremstad (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 29, 1961. Contract AT(45-1)-1350. 9p.

The Health and Safety Lab. data were analyzed statistically to determine the influence of vegetation zones on the Cs^{137}/g of K content of dried milk products. Ten out of a possible eleven milk sampling stations of the monitoring network of worldwide fallout in the northwestern United States were grouped into three broad natural vegetation zones characteristic of this region. The results show significant differences in Cs^{137}/g of K in milk samples between vegetation zones. The milk samples from the grassland zone averaged less Cs^{137}/g of K than those from the forest zone and the samples from the sagebrush zone showed lesser amounts than either of these. The differences in Cs^{137}/g of K in dried milk appears as a result of the amounts of Cs^{137} deposited over the landscape via precipitation rather than to any great differences in kinds of available forage. (auth)

5753 (NRL-5850) INTERCALIBRATION OF SOME SYSTEMS EMPLOYED IN MONITORING FISSION PRODUCTS IN THE ATMOSPHERE. L. B. Lockhart, Jr., and R. L. Patterson, Jr. (Naval Research Lab., Washington, D. C.). Sept. 12, 1962. 23p.

A study has been made of some of the systems involved in measuring the concentrations of fission products in the air at ground level and a direct comparison made of radioactivity results reported from each of the systems on replicate samples made at the same time and place over an extended period. Some information on the filtration characteristics of the various filter media is also included. The experimentally determined relative radioactivity concentrations of identical air samples from which interconversion factors can be derived for directly comparing any of the systems with another are as follows: NRL air monitor, 1.00; U. S. Public Health Service Radiation Surveillance Network, 1.17; Canadian Air Monitoring Network, 1.82; NRL 80th Meridian Network, 2.07. These ratios are based on the sampling of a known volume of air; there is presently some degree of uncertainty as to the actual volume of air sampled at the various field sites of the three operating networks. (auth)

5754 (PG-Report-408) A CHEAP DISPOSABLE FILTER AND ASSAY UNIT FOR AIRBORNE RADIOIODINE ISOTOPES. G. Pearson, J. W. R. Dutton, and F. Elliott (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 5p.

A combination of Millipore PH filter paper and activated charcoal has proved suitable for sampling airborne radioiodine. The efficiency of the combination is shown to be greater than 90%. (auth)

5755 (UCLA-497) THE OCCURRENCE, EFFECT AND UTILIZATION OF SPECIFIC ISOTOPES IN THE ENVIRONMENT: REVIEW AND DISCUSSION OF BARIUM. Norman R. French (California, Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). Dec. 1961. Contract AT(04-1)-Gen-12. 20p.

Barium-140 is the most important fission product isotope of Ba. It is chemically similar to other alkaline earths, and generally considered in biological studies to be similar to Sr. There is evidence for differences in metabolic handling of the two elements. Because of the 12.8-day half life, Ba^{140} is important to ecological systems for only a few weeks after it is produced. Barium is concentrated by insects, and by some plants. Aquatic organisms concentrate it directly from water. A small fraction of the ingested Ba is absorbed by mammals. Incorporation and expected pathways in the ecosystem are discussed. (auth)

5756 DAILY PERIODICITY IN THE TRANSPORT OF ORGANIC PLANT SUBSTANCES. A. A. Anisimov, E. K. Fuzina, L. A. Dobryakova, and E. V. Likhovidova (Gor'kovskii State Univ., USSR). Doklady Akad. Nauk SSSR, 146: 1441-4(Oct. 21, 1962). (In Russian)

Corn, sunflower, potato, and cucumber plants 30 to 40 days old were exposed for one hour to a 3% CO_2 atmosphere containing 50 μC of C^{14} per liter of gas. Then, the plants were maintained 4 to 8 hours under natural illumination for various periods of the day (from 10 to 14 o'clock, from 14 to 18 o'clock, and from 22 to 6 o'clock in the morning). The roots, stems, and leaves were then separated and counted on an end-window counter. The relative transport rate was estimated from the percentage activity in the root or stem. The decrease in activity per unit surface area per hour was also determined, and a correction was made for the respiratory loss. Movement of organic matter from the leaves to other parts of the plant takes place during all periods of the day. The most active transport was noted in the corn seedlings, and the least active in the potato seedlings. The sunflower was similar to the corn plants in behavior, while the cucumber was closer to the potato. In two of the plants (potato and sunflower), the transport of organic substances from the leaves increased during the night hours. The transport rate rose, but did not attain its maximum during the night hours in the potato plant. The movement of organic matter to the roots was greatest during the night hours in all experiments. (TTT)

5757 HYGIENIC EVALUATION OF RADIOACTIVE IODINE ACCUMULATION IN FRESH-WATER FISH. A. Ya. Loshak (Central Graduate School of Medicine, USSR). Gigiena i Sanit., 27: No. 6, 93-5(June 1962). (In Russian)

Tests indicate the high uptake of I^{131} by year-old carp (exceeding the specific activity of water by an order of 1 to 2). The maximum uptake was reached following 2 to 3 weeks of exposure to I^{131} in water and was retained at the same level during the length of the experiment. (R.V.J.)

5758 STUDIES IN RADIOACTIVE FALLOUT IN NEW ZEALAND. PART 2. THE TOTAL BETA ACTIVITY OF RAINWATER (SEPTEMBER 1956–June 1959). G. S. McNaughton (Inst. of Nuclear Sciences, Hutt, New Zealand). New Zealand J. Sci., 5: 198-220(June 1962).

The decay rate of the total β activity has been measured from monthly rainwater samples collected at six New Zealand sites from September 1956 to June 1959. By comparison of this rate with the rate of decay of the slow neutron fission products of U^{235}, an estimate was made of the month in which the fission products in each sample were formed. From the relative ages of successive samples, it was concluded that about 10 successive waves of fresher fission product activity were deposited in the rainwater over the 2-yr period. Possible nuclear test series which caused these waves are suggested. A greatly increased amount of short-lived radioactive material was deposited in the north of New Zealand after the U.K. test series in Australia in 1957, although the U.K. Pacific tests in May contributed most of the total β activity in the latter half of 1957. The next major influxes of debris came from the latter half of

1958 from U.S. and U.K. Pacific tests. The relative aging of the 1959 samples is supported by Sr^{90} and Ce^{144} determinations. It is possible that some U.S.S.R. October 1958 debris was detected in March–June 1959. If this deduction is valid, upper limits of 25% and 9% have been calculated for the Sr^{90} deposition at Auckland (37°S) from this source during the period January–June 1959, depending on whether data for thermal fission of U^{235}, or for 14 Mev fission of U^{238} are used. The estimated upper limits for Russian Sr^{90} deposited at Wellington (41°S) in the same period is probably not more than $^2/_3$ of this. The accumulated deposition of total β activity over the 2-yr period was approximately proportional to the amount of rainfall at the collection site, although there was a decrease of 35% in the specific activity of the rain from the most northerly site to that furthest south. Age measurements suggest that this might be due in part to the longer time taken for the debris to travel further south, rather than solely due to a dilution phenomenon. (auth)

5759 THE EFFECT OF UNITHIOL ON THE RATE OF RESORPTION OF SUBCUTANEOUSLY INJECTED POLONIUM. M. G. Zotova. Radiobiologiya, 2: 705-8 (1962). (In Russian)

White male rats 150 to 200 g in weight were divided into two groups. One group of rats was given 100 mg of unithiol per kg body weight two times a day, and the other group served as controls. The polonium was injected in the thigh of the back leg at a dose of 0.01 mc/kg of body weight. The content of polonium in the body of the rat and at site of injection was determined at 3 and 5 hours, and on the 1st, 2nd, 3rd, 5th, 7th, 8th, 9th, 10th, 14th, 15th, 30th, 43rd, and 60th day after injection of the polonium. Without the unithiol treatment, 38% of the Po is absorbed into the organism in 3 hours, 50% in 5 hours, 70% in 5 days, and 80% in 7 days. With the unithiol treatment, the rate of Po absorption is more rapid. The absorption of Po into the organism was 86% after 3 hours. The administration of unithiol 7 days after the injection of the Po had no effect on the absorption of Po into the organism from the site of injection. Autoradiographs taken at the site of Po injection showed that unithiol promoted the adsorption of Po into the organism from the site of injection. (TTT)

5760 RADIATION STANDARDS, INCLUDING FALLOUT. SUMMARY-ANALYSIS OF HEARINGS HELD ON JUNE 4, 5, 6, AND 7, 1962, BEFORE THE SUBCOMMITTEE ON RESEARCH, DEVELOPMENT, AND RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES. (United States. Congress. Joint Committee on Atomic Energy). Sept. 1962. 64p. (GPO).

The Subcommittee on Research, Development, and Radiation of the Joint Committee on Atomic Energy, Congress of the United States, held hearings June 4 through 7, 1962, on radiation standards and fallout. Prospective witnesses and panel members from government, industry, universities, and other affiliations were asked to prepare statements for these hearings and a similar cross section of individuals were requested to submit statements for the record. The major highlights of these hearings are summarized and their significance is discussed. (C.H.)

5761 RADIATION STANDARDS, INCLUDING FALLOUT. HEARINGS BEFORE THE SUBCOMMITTEE ON RESEARCH, DEVELOPMENT, AND RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SEVENTH CONGRESS, SECOND SESSION, JUNE 4, 5, 6 AND 7, 1962. PART 1. PART 2, APPENDIX. (United States. Congress. Joint Committee on Atomic Energy). 1962. 1040p. (GPO).

Hearings on radiation standards including fallout, were held before the subcommittee on Research, Development, and Radiation of the Joint Committee on Atomic Energy of the Congress of the United States on June 4 through 7, 1962. A number of scientists presented information orally and in detailed written statements on various aspects of the subject. Information previously developed on fallout and radiation standards was updated. An attempt was made to identify and clarify the policy problems and organizational responsibilities associated with the establishment and administration of radiation standards. The somatic and genetic effects of man-made radiation were reviewed from the standpoint of permissble levels of radiation exposure. Pertinent written statements are appended. (C.H.)

Radiation Effects on Living Tissues

5762 (AD-276039) TISSUE TRANSPLANTATION: HOMOGRAFT ANTIGENS, IONIZING RADIATION AND OTHER FACTORS INFLUENCING HOMOGRAFT SURVIVAL. Progress Report, June 1, 1961–May 31, 1962. Gustave J. Dammin, J. Mackie Corson, and Lewis T. Mann, Jr. (Harvard Univ., Boston. Medical School). Contract CA-49-193-MD-2061. 14p.

Progress is reported in studies of reactions to transplanted organs and tissues in man and animals. Modifications were made in the method for extracting antigens from mouse spleen cells. The essential constituents of this active fraction are protein and lipid. In studies of the canine splenic homograft, it was concluded that an early graft versus host reaction was present for a period probably not exceeding 48 hours. This was followed promptly by a progressive increase in cellularity of the splenic homograft. Suppression of the host's marrow and lymphoid tissues with nitrogen mustard prevented the lymphocytic and plasmocytic infiltration of the splenic homograft and prolonged its survival. Few dogs survived long enough to determine precisely how the host was modified, but it did appear that there might be a prolongation of the graft versus host response induced by the nitrogen mustard. It was plain that the aim of attaining a state of mutual tolerance had not been achieved. The best survival achieved thus far for the canine renal homograft has followed a program consisting of the initial administration of 6 mercaptopurine, with BW57-322 given as a daily dose, with periodic addition of Actinomycin C. With this program, more than half of the dogs survived more than 30 days, with the renal homograft as the only renal tissue in the recipient. A similar program has been followed in man for the first time and has resulted in the longest survival obtained thus far with chemical treatment only. The characteristics of synthetic polypeptides as antigens were defined further. Amino acid content as well as sequence are important determinants of antigenicity. This is borne out also by examination of the inhibitory effects on antigen-antibody combination by amino acids and dipeptides. (auth)

5763 (AE-80) INVESTIGATION OF THE 800 kev PEAK IN THE GAMMA SPECTRUM OF SWEDISH LAPLANDERS. I. Ö. Andersson, I. Nilsson, and K. Eckerstig (Aktiebolaget Atomenergi, Stockholm). Aug. 1962. 9p.

Whole-body counting of 12 Swedish Laplanders in 1961 showed high levels of Cs^{137}. The high Cs^{137} content is attributed to the consumption of reindeer meat by Laplanders. The high Cs^{137} uptake by reindeer is related to the

special grazing habits of this animal. The ratio of atmospheric Cs^{134} to Cs^{137} and the contribution of nuclear accidents and fallout from nuclear explosions to atmospheric Cs^{134}/Cs^{137} activities are discussed. (C.H.)

5764 (AERE-R-3334) INSTRUCTION MANUAL FOR THE HARWELL CAESIUM 137 BEAM THERAPY UNIT Mk II. R. L. Otlet (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). May 1960. 30p.

The Harwell Mark II Cs^{137} beam therapy unit was designed to contain kilocurie sources of Cs^{137} prepared from fission products. Design features are described. Instructions are included for the operation and maintenance of the unit. (C.H.)

5765 (AFCRL-62-244) BIOASTRONAUTICAL MEASUREMENTS OF IONIZING RADIATIONS IN SPACE: NUCLEAR EMULSION MONITORING REPORT. GRD Research Notes No. 76. Herman Yagoda (Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.). Feb. 1962. 43p. (AD-274001)

During the summer of 1960, a series of four instrumented balloons were launched from Bemidji, Minnesota, to secure cosmic ray data at high elevations and to study the effects of the radiations on biological systems. It was hoped that one of the flights might be coincident with a solar flare which would give rise to a large increase in radiation dosage resulting from an influx of solar protons which at times penetrate the atmosphere in appreciable abundance at balloon elevations. Each of the flights carried small units of nuclear emulsion to provide standardization data for other electronic instrumentation and to serve as directional monitors for heavy primary radiation penetrating the brains of the animals. Measurements were made of star production frequencies, proton enders, and heavy primary thindown hits. As a measure of solar proton enhancement, counts were made of the frequency of proton track enders in the emulsion. The ender production was essentially constant on all four flights and varied between 498 and 604 tracks cc^{-1} hr^{-1}, in agreement with earlier measurements in Minnesota, indicating the absence of any flare phenomena. It is suggested that the ratio of proton enders to stars may prove a useful parameter for indicating exposure to solar protons at balloon elevations, and small doses of trapped particles in animals flown in space probes and satellites which approach or graze the lower Van Allen belt. (auth)

5766 (BNL-5538) A METHOD OF EFFECTIVELY WIDENING THE BRAGG PEAK IN DEPTH IN THE PATH OF CHARGED HEAVY PARTICLES IN TISSUE. C. R. Jansen, C. Baker, W. Calvo, K. R. Rai, and S. Lippincott (Brookhaven National Lab., Upton, N. Y.). [1960]. Contract [AT-30-2-GEN-16]. 15p.

A device is described for the filtration of charged energetic heavy particles resulting in the production of adjacent or separated Bragg peaks within the range of the particles in tissue. Two or more layers of intense ionization at different depths separated by layers of less ionization in tissue can be produced. A cylinder of uniform ionization which cuts off sharply in depth in tissue can also be produced. (auth)

5767 (BNL-5727) THE EFFECTS OF IONIZING RADIATION ON ENZYMES. L. G. Augenstine (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT(30-2)-Gen-16]. 72p.

Data are received on mechanisms involved in the radio-induced inactivation of enzymes. Both direct and indirect effects in dried preparations, aqueous solutions, and heterogeneous systems are discussed. (274 references.) (C.H.)

5768 (HW-SA-2493) THYROID ADENOMAS IN SHEEP FED RADIOIODINE. Sidney Marks and Leo K. Bustad (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Mar. 14, 1962]. Contract AT(45-1)-1350. 43p.

The development of thyroid adenomas at an age of four to eight years is reported for ten sheep fed daily quantities of I^{131} ranging from 1.5 to 135 μc. Combining these results with the occurrence of adenomas previously reported in four sheep and a fibrosarcoma in a fifth gives an incidence of 15 animals bearing thyroid neoplasms out of 18 treated with the stated quantities. The exposure to I^{131} was either continuous from conception or initiated at an age of 15 months. The radiation doses to the thyroid glands were estimated to range from 7,000 to over 100,000 rads for the affected animals. Thyroid adenomas in control sheep were limited to animals ten years of age or older but were identical in appearance to those of the experimental animals. The histologic characteristics of the adenomas are described. The mechanism of stimulation of the thyroid gland by an excessive output of thyroid stimulating hormone was invoked to explain the abnormal incidence of adenomas in the sheep fed I^{131}. (auth)

5769 (HW-SA-2540) ANTIBIOTIC RESISTANCE AND RADIATION INDUCED MUTATION IN CHONDROCOCCUS COLUMNARIS. M. P. Fujihara, P. A. Olson, and F. P. Hungate (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 16, 1962. Contract AT(45-1)-1350. 14p.

Of several antibiotics tested tetracycline, chlortetracycline, and erythromycin were found to be most effective in preventing growth of Chondrococcus columnaris. Mutation rate in C. columnaris was evaluated by determining the x-ray induced increase in frequency of organisms resistant to distrycin. A fifteen-fold increase over the spontaneous mutation rate was observed when cells were irradiated with 10 kr, a dose which killed 99% of the cells. Mortality of fish exposed to irradiated organisms and a radiation-induced mutant was similar to mortality of fish infected with control cells. (auth)

5770 (MDC-TDR-62-3) RELATIVE BIOLOGICAL EFFECTIVENESS OF EXTREMELY ENERGETIC PROTONS AND ALPHA PARTICLES. Richard C. Fix, Jeanne M. McConomy, Charles K. Levy, and James A. Wall (Controls for Radiation, Inc., Cambridge, Mass.). Feb. 1962. Contract AF 29(600)-2340. 80p. (AD-275262)

The relative biological effectiveness (RBE) for extremely energetic protons and alpha particles was studied. Ehrlich ascites tumor cells were exposed in vitro, in nitrogen to 60, 120, 410, and 730 Mev protons, 240, 600, and 900 Mev alpha particles, and 250 kev x rays. The LET range covered was from 2.4 to 37.2 Mev/g/sq cm. The production of abnormal anaphase at 24 hours was used as the criterion for damage. Comparison of the slopes of the percent normal anaphase versus dose curves for the various particles and energies to that for 250 kev x rays (RBE = 1) gave RBE values for the radiation listed above of 0.44, 0.88, 0.61, 0.84, 0.93, 0.91, and 0.90 (average) respectively. The RBE for 60 Mev protons and perhaps 410 Mev protons which have LET values of approximately 9.5 and 3.0 Mev/g/sq cm respectively are not consistent with the other values. The 60 Mev proton value may have resulted from a change in radiosensitivity of the tumor cell, since it

was the last irradiation performed; however, this has not been confirmed. (auth)

5771 (TID-13275) GLYCEROL AND OXYGEN EFFECTS ON X-RAY SENSITIVITY IN STAPHYLOCOCCUS AUREUS. R. B. Webb (Argonne National Lab., Ill.). Apr 1961. Contract [W-31-109-eng-38]. 14p. (UAC-5205)

Comparison of the X-ray sensitivity of Staphylococcus aureus suspended in buffer and in high concentrations of glycerol in air and in nitrogen showed that in this system the protective action of glycerol is due largely to an effect other than preventing the usually observed oxygen sensitization. First, glycerol affords much more protection than anoxia. Second, removal of oxygen from cells in a high concentration of glycerol results in a further substantial reduction in X-ray sensitivity. Lyophilization results in a decrease in sensitivity similar to that in high levels of glycerol which with other results presented supports the previous suggestion that glycerol primarily affects the water component of the cell. It is suggested that the important water in the glycerol effect may be that associated with macromolecules of the cell. (auth)

5772 (TID-13322) LIPID COMPOSITION OF LIVER MITOCHONDRIA FROM NORMAL AND X-RAY IRRADIATED FASTED RATS. H. P. Schwarz, L. Dreisbach, M. Barrionuevo, A. Kleschick, and I. Kostyk (Philadelphia General Hospital). [July 27, 1961]. Contract AT(30-1)-1864. 22p.

When mitochondrial lipids from non-irradiated or irradiated fasted rats were fractionated on silicic acid columns with strict precautions to avoid oxidation a mixture of phosphatidic acid polymers of cardiolipin-like structure was isolated. The mitochondrial cardiolipins showed paper chromatograms, infrared spectra, and fatty acids resembling those of pure commercial cardiolipins. The cardiolipin phosphorus of the liver mitochondria of fasted rats was estimated to be about 9% of the total lipid phosphorus of the material. Whole-body x-irradiation caused a significant elevation of the total lipids and total phospholipids of the liver mitochondria, which could be accounted for by a proportionate elevation of the cardiolipin fraction. Other phospholipid fractions were little affected by irradiation. (C.H.)

5773 (TID-13613) THE GROWTH OF MONODISPERSE POPULATIONS OF MAMMALIAN CELLS EXPOSED TO INTERNAL BETA IRRADIATION. Donald F. Petersen (Los Alamos Scientific Lab., N. Mex.). 1961. Contract [W-7405-eng-36]. 18p.

HeLa cells adapted to grow in agitated fluid medium were maintained under suitable culture conditions until the cells multiplied largely as monodisperse populations. An electronic particle counter, equipped with a 100-channel pulse height analyzer, was used to enumerate and determine the size of intact cells and nuclei derived from the cultures. Radioactivity was introduced into the cultures during logarithmic growth either as tritiated thymidine or as tritium water. The biological effects of internal β irradiation were evaluated in terms of the decrement in growth observed in succeeding generations as a function of growth rate. The data clearly demonstrate that tritiated thymidine is more effective in inhibiting cell growth than in tritium water. Possible reaction mechanisms involved are discussed. (C.H.)

5774 (TID-13984) THE GODIVA II CRITICAL ASSEMBLY: DOSIMETRY FOR BIOLOGICAL RESEARCH. Joseph A. Sayeg (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 33p. (LADC-4189).

The Los Alamos Godiva II critical assembly is a bare reactor of approximately 60 kg enriched U^{235}. The assembly can be used as a burst facility delivering up to 20,000 tissue rads in a 70 μsec pulse, or can be used as a normal reactor delivering the same dose over a longer time. Four methods have been used to evaluate the neutron and γ tissue dose versus distance relation. These include (1) a method employing the threshold detectors Pu^{239} surrounded by 2 cm of B^{10}, Np^{237}, U^{238}, and S^{32} for the measurement of fast neutron tissue dose and bare cadmium-covered Au^{197} foils for the measurement of thermal neutron tissue dose, (2) the Hurst proportional counter for the measurement of neutron tissue dose, (3) tissue-equivalent and graphite-CO_2 ionization chambers for the measurement of neutron and γ-tissue dose, (4) and tetrachloroethylene chemical dosimeters for the measurement of γ-dose only. Instruments and procedures of the methods are described and the accuracy of the methods is discussed. (C.H.)

5775 (TID-14529) [BODY Na^{24} ACTIVITY AS A MEASURE OF BODY DOSE]. E. R. Ballinger and P. S. Harris (Los Alamos Scientific Lab., N. Mex.). 1962. Contract [W-7405-eng-36]. 21p. (LADC-5055)

Problems of casualty assessment following radiation accidents involving neutron exposure are discussed. A portable rate meter and probe assembly is described which was developed to externally measure induced body activity relative to the incident neutron tissue dose delivered. The detector was calibrated for activity from Na^{24} that has a half life of 14.8 hrs. Screening of suspected exposures can be accomplished in 5 to 60 sec by placing the probe over the lumbar area of the back. The instrument and its use are described in detail. (C.H.)

5776 (TID-14698) ACQUIRED RADIORESISTANCE. Howard H. Vogel, Jr. and Donn L. Jordan (Argonne National Lab., Ill.). Oct. 1961. Contract [W-31-109-eng-38]. 14p. (UAC-5786)

To test the hypothesis of acquired radioresistance, young adult, female mice (CF No. 1) were irradiated with single brief 50-rad doses of either fission neutrons or Co^{60} γ rays. At 7, 14, 21, or 70 days following the preliminary 50 rads, these mice were exposed to a second dose in the midlethal range (320 rads neutrons or 900 rads γ rays). At the time of these second exposures, a similar group of age controls was also irradiated. These and the doubly-irradiated mice were handled in exactly the same manner except that the controls had not received the first dose of 50 rads. Since 4 combinations of the radiations were utilized, each being tested at 4 intervals, there were 16 experimental groups, each with its own age control with 24 to 32 mice per group. If prior exposure to 50 rads produced significant radioresistance to a second dose, the experimentals should show less acute mortality than their controls which had not received a conditioning dose. In comparing the proportions of 30-day decedents between the 16 experimental and control groups, 11 showed higher mortality in the experimentals, 4 with highly significant differences. In only 2 control groups, of the 16, was there a considerably higher 30-day mortality and neither of these differences was significant. This experiment therefore gave no positive evidence in favor of any significant radioresistance acquired by mice exposed to 50 rads of neutrons or γ-rays. (auth)

5777 (TID-15181) COMPARATIVE RESISTANCE OF THREE GROUPS OF MICE — WITH DIFFERENT ANCESTRAL HISTORIES OF RADIATION EXPOSURE — TO LOW INTENSITY GAMMA IRRADIATION. J. F. Spalding and

V. G. Strang (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 14p. (LADC-5269)

The comparative resistance of three groups of mice, with different histories of ancestral x-ray exposure, to protracted low-intensity γ-rays was observed. Mice from ancestors with 15 generations of x-ray exposure to the sires were approximately 28% less resistant, and mice with 10 generations of x-ray exposure to the sires followed by 5 generations of no x-ray exposure were approximately 25% less resistant to protracted γ-ray stress than were control mice. (auth)

5778 (TID-15521) EFFECT OF X-RAYS ON THE FISSION RATE OF PARAMECIUM AURELIA. G. A. Sacher, E. L. Powers, Deborah Shefner, and Joan M. Gurian (Argonne National Lab., Ill.). Jan. 1962. Contract [W-31-109-eng-38]. 37p. (UAC-6150)

Data are presented on the recovery of fission rate of P. aurelia after exposure to single doses of x-rays. Over a wide range of doses and times, the course of recovery can be fitted with a 3-parameter logistic surface. This finding is interpreted to mean that radiation exposure inactivates intracellular particles but in so doing does not grossly disturb the normal kinetics of regrowth initiated by the remanent intact particles. The multiplicity of the hypothetical particles is very high—on the order of 10^3 or more. A number of cytoplasmic and macronuclear entities in Paramecium have multiplicities on this order. Two quite different kinetic models are shown to be equally applicable to the available data. Some implications of this ambiguity are considered. An interpretation of the division lag following irradiation is offered. (auth)

5779 (UCSF-22) RADIOLOGICAL LABORATORY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 30, 1962. (California. Univ., San Francisco. School of Medicine. Radiological Lab.). Nov. 1962. Contract AT-11-1-GEN-10. 70p.

Applications of 70-Mev x rays from the medical synchrotron in the treatment of patients with cancer are reviewed for a 7-year period. It is concluded that the 70-Mev synchrotron is a very valuable tool in the treatment of deeply located cancer. Dosimetry systems and operation of the synchrotron are discussed. Data are presented from a 3-year study on the rate of recovery of bone marrow in several mouse strains and hamsters from the accute effects of whole-body exposure to x rays. Results indicate that similar physiological mechanisms were at work in each animal but that genetic factors introduced quantitative differences in response. Preliminary data are included from studies on late bone marrow injury in normal and parabiotic rats, radiation damage in kidneys, the effects of age on response to radiation injuries, genetic factors affecting the lifespan of the progeny of irradiated male mice, and the suitability of the histocompatibility system in mice for genetic studies relating to radioinduced mutations. A survey on 499 cases of carcinoma of the cervex that had survived 5 years after radiation treatment indicated that the survival of such patients is independent of the stage of their disease at the time of diagnosis and that it is also independent of the regional volume dose of x rays within the range of doses employed. For the population studied, increased x radiation was without significant harm but data indicate that undertreatment leads to unsatisfactory results. (C.H.)

5780 (USNRDL-TR-583) NEUTRON AND GAMMA-RAY DOSIMETRY IN AN ANIMAL EXPOSURE VOLUME AT A PULSED TRIGA REACTOR. R. E. Simpson, E. Tochilin, and N. Goldstein (Naval Radiological Defense Lab., San Francisco). Sept. 17, 1962. 30p.

The distribution of steady-state and pulsed neutron and gamma-ray dose was measured in an animal exposure volume at the TRIGA reactor. The usable volume was restricted to the lower 20 in. of an aluminum irradiation tube having an ID of 9.5 in. The tube was inserted into the pool adjacent to the reactor void tank, 134 cm from the core. Dosimetry films were used to determine gamma-ray dose while Sievert ionization chambers were used to determine neutron dose. Gold foils were used to measure the thermal neutron flux. Neutron doses were referenced to sulphur foil monitors. The neutron spectrum was examined with a system of threshold detectors and compared with spectra from Godiva II and the biological port of the Argonne CP-5 reactor. The vertical variation of dose along a lucite board, designed for retaining mice, was measured at the midplane of a lucite canister lowered into the tube. The dose in the lower 16 in. was found to vary less than 5 percent. The ratio of neutron to gamma dose was approximately 6 to 1. A tissue equivalent dog phantom, 20 in. long and 7.5 in. in diameter, was designed to determine the absorbed dose in depth. The fast neutron dose was about equal to the gamma-ray dose at the midline of the phantom having dropped from 2.3 times the gamma-ray dose in front of the phantom. The neutron plus gamma-ray dose at the midline was 44 percent of the dose at the front surface of the phantom. Bilateral exposure doses were computed from the unilateral exposures. (auth)

5781 (FTD-TT-62-771) THE EFFECT OF COSMIC RADIATION ON PLANT ACTIVITY. A. Shakhov. Translated from Zh. Obshch. Biol., 23: No. 2, 81-9(1962). 21p.

By combining natural radiation with radiation from artificial sources of ultraviolet, radiation conditions close to those of space can be created in the highlands of Eastern Pamir at altitudes of 4000 to 5000 m where the air is exceptionally dry and transparent and solar radiation has great intensity and specific spectral distribution. The phenomenon of photoadaptation through the generations and also photoreactivation induced by visible light is distinctly expressed in plants found under such quasi-cosmic radiation conditions. These phenomena can be of considerable importance in studies of space-biology since plants acquire the ability to withstand, without dying, considerable doses of UV-radiation with high-energy quanta. Here their activity and photosynthesis proceed normally, or in certain species are slightly depressed. Under the effect of UV-irradiation, plants develop the ability to utilize more fully the energy of visible light, expecially in the region of green and near-infrared rays. UV-irradiation changes the submicroscopic structure of the chloroplasts and also the lipid metabolism taking place in them. (auth)

5782 (JPRS-15872) EFFECT OF IONIZING RADIATION OF THE HEART. P. D. Gorizontov. Translated from Kardiologiya, 2: No. 4, 3-9(1962). 12p.

Results are reviewed from a number of studies on the effects of radiation on heart activity. The effects of radiation on nerves, blood vessels, and myocardium are considered. It is concluded that the pathogenesis of disruption of heart activity by radiation has a complex origin connected with several factors. (C.H.)

5783 STUDIES ON WHOLE-BODY X IRRADIATION EFFECTS ON ANAPHYLACTIC HYPERSENSITIVITY IN GUINEA PIGS. Š. Vlahović and V. Stanković (Inst. Rudjer Bošković, Zagreb). Acta Allergol., 16: 329-36(1961). (In English)

Guinea pigs were sensitized with and then challenged with horse serum 14 days later. The anaphylactic reactions of this group were taken as control and compared with the anaphylactic reactions observed in animals sensitized from 30 min to 14 days before irradiation (350 or 400 r), and with the reactions observed in animals sensitized from 30 min to 14 days after the exposure to the same doses of x rays. The reactions in animals sensitized after irradiation were much less than those observed in controls; no lethal response was observed. However, the anaphylactic response in animals sensitized before irradiation showed a higher percentage of fatal reaction than in the unirradiated group. The lethal anaphylactic response depended on how long before irradiation sensitization was performed. Eighty percent of guinea pigs sensitized from 1 to 14 days before irradiation gave a fatal reaction on subsequent challenge. Animals sensitized 30 min, 6 hr, or 12 hr before irradiation showed the same mortality rate as the control unirradiated group. In experiments on the passive transfer of anaphylactic hypersensitivity, pooled blood serum obtained from normal or irradiated guinea pigs 14 days after sensitization, viz. 15 days after irradiation, was injected intraperitoneally into normal or irradiated animals. Serum obtained from normal guinea pigs 14 days after sensitization was injected intraperitoneally into normal or irradiated animals (5 days after exposure to 400 or 450 r). All passively sensitized animals showed an anaphylactic reaction after challenge (24 hr after receiving the sensitizing serum), and no effect of irradiation was detectable. In the 2nd experiment, serum was obtained from guinea pigs sensitized 24 hr after irradiation with 300 r. The normal recipients manifested an appreciably weaker anaphylactic response to challenge than after receiving serum from normal sensitized animals. Thus, the blood of irradiated sensitized animals contained fewer circulating antibodies. (H.H.D.)

5784 THE INFLUENCE OF ROENTGEN RADIATION ON OXIDATIVE PHOSPHORYLATION IN ISOLATED MITOCHONDRIA. H. J. Altenbrunn and E. Kobbert (Forschungsgemeinschaft der Deutschen Akademie der Wissenschaften, Berlin). Acta Biol. Med. Ger., 7: 251-60(1961). (In German)

Mitochondria were sedimented from homogenates of rat liver in either isotonic sucrose medium or in isotonic KCl-mannitol medium. Oxidative phosphorylation, or the P/O ratio, was greater in sucrose than in the other medium in the presence of various substrates. Irradiation of mitochondria suspended in sucrose with 200-kv x rays at doses between 750 and 40000 r had no effect on respiration, phosphorylation, or P/O ratio in the presence of various substrates of the citric acid cycle, glutamic acid, or β-hydroxybutyric acid. In the presence of α-ketoglutarate, respiration and phosphorylation increased ~10 to 20% after 40000-r irradiation but the P/O ratio was unaffected. Irradiation of mitochondria suspended in isotonic KCl-mannitol solution resulted in a fall in respiration, phosphorylation, and the P/O ratio in the presence of all of the substrates tested. The metabolic activities of unirradiated mitochondria remained high when stored in isotonic sucrose for 24 hr but fell sharply by that time in the 2nd medium. (H.H.D.)

5785 HISTOLOGICAL CHANGES AND CHRONOLOGICAL TRANSITIONS OF THE BONE MARROW OF A-BOMB SURVIVORS DYING OF NON-HAEMATOLOGICAL DISORDERS. S. Matsuoka and Y. Katsura (Nagasaki Univ.). Acta Pathol. Japan., 9: Suppl., 835(1959).

Bone marrow from the vertebrae and sternum of 35 cases of cardiovascular disease, 33 of pulmonary tuberculosis, 18 of gastric carcinoma, 18 of carcinoma of other organs, and 7 of bronchopneumonia among A-bomb-exposed persons was compared with the marrow of non-exposed patients. Cellular elements were markedly increased, especially premature cells of the granulocytic series, and inhibition of maturation was noted. Foci of proliferating cells younger than myeloblasts were seen occasionally between the fatty cells or around the sinuses, the bony trabeculae or radially around the blood vessels and were termed blast foci. Most of the exposed cases showed blast foci, which were not found in any of the control cases. All those who had been close to the epicenter showed prominent blast foci, while those who had been exposed at a distance or shielded in a concrete building revealed few or no blast foci. A case of excessive x irradiation showed similar foci. The blast foci showed occasionally a tendency to diffuse proliferation similar to that of neoplasms. Similar foci were seen in cases of myeloid leukemia. The bone marrow of an additional 78 persons who had been within 3000 m of the epicenter was examined repeatedly from 1957 to 1959. The number and severity of blast foci were found to decrease gradually with time, suggesting that the probability of leukemia developing among A-bomb survivors may decrease as time passes. (Abstr. Japan Med., 2: No. 9, Sept. 1962.)

5786 THE EFFECT OF X IRRADIATION ON THE SPREAD OF TICK-BORNE ENCEPHALITIS VIRUS THROUGH THE REGIONAL LYMPHATIC SYSTEM. D. Malková (Czechoslovak Academy of Sciences, Prague). Acta Virol. (Prague), 6: 475-6(Sept. 1962).

Studies were made to ascertain whether changes caused in the lymphatic system by x radiation would affect penetration of the virus through the lymphatic system into the blood stream. Mice given 300 or 600 r were inoculated intraplantarly either on the 5th or 13th day after irradiation. Irradiation with either single dose led to a decrease in virus in regional lymph nodes and blood, if the animals were inoculated 5 days after irradiation. The decrease in virus titer was most marked in mice irradiated with a dose of 600 r and inoculated with 1500 LD_{50} of virus. The titer of virus in the organs examined remained unaffected as long as the virus did not penetrate the regional lymphatic system into blood. The slower penetration of virus through the lymphatic system of irradiated mice was apparently caused by general changes in the lymphatic system, although it appears probable that an important factor was also the decreased number of lymphocytes, which may act as carriers of virus. (H.H.D.)

5787 STUDY OF RADIATION NECROSIS OF THE URINARY BLADDER FOLLOWING TREATMENT OF CARCINOMA OF THE CERVIX. M. K. Basu Mallik (Chelsea Hospital for Women, London). Am. J. Obstet. Gynecol., 83: 393-400(Feb. 1962).

Injury of the bladder, as well as its diagnosis and treatment, is described in 5 patients treated with Ra implantation (5600 to 7900 mg/hr). Minor bladder disturbances, such as frequency and dysuria, are found in about 14.5% of all irradiated cases. The intensity of immediate reactions has no bearing on the development of late devitalization reactions. The time of appearance of these late necrotic reactions varies greatly, but in all cases were found within 3 years. The symptoms develop suddenly and consist of increased frequency of micturition, pain, dysuria, and hematuria. To prevent such injuries a correct technique for application of Ra is essential. Ra needles in boxes should be placed in the vagina in a sagittal plane and not otherwise. To prevent any error of application, it is suggested

that the rubber boxes containing Ra for vaginal application should have longitudinal striations parallel to the long axis of the needles. Overdosage of radiotherapy should be avoided by measuring the dosage of irradiation received by the bladder and the rectum and at other different points in the pelvis. A scintillation dose rate meter was found to be very useful for this. Experimentally it was found that if the total bladder dose remains below 6,000 r (approximately 1.5 r/min) and the total rectal dose below 4,000 r (1 r/min) complications are seldom encountered. X-ray pictures of the pelvis should be taken after the patient is returned to bed to ensure that the Ra needle is in the correct position. If excessive radiation is the cause of necrosis, both bladder and rectum will be damaged, the latter more so. (H.H.D.)

5788 THE EFFECT OF X IRRADIATION AND CYSTEAMINE ON THE BARBITURATE SLEEPING TIME IN RATS. V. Varagić, S. Stepanović, and S. Hajduković (Inst. for Nuclear Sciences "Boris Kidric," Belgrade). Arch. Intern. Pharmacodyn., 138: 113-9(July 1, 1962).

Whole-body x irradiation with 600 and 800 r prolongs barbiturate sleeping time in the rat. In the head-irradiated animals (with the same doses) no prolongation of barbiturate sleeping time was observed. Irradiation of the animal with the head shielded produced the same effect as irradiation of the whole body. Cysteamine depressed or even blocked the prolonging action of x irradiation on barbiturate sleeping time. This action of cysteamine was evident 24 hr after irradiation and was still present 30 days after irradiation. The prolonging effect of x irradiation was significant as early as 24 hr after exposure but was more pronounced 14, 21, and 30 days after irradiation. This suggests that even the primary event which takes place immediately after absorption of radiation energy produces a change in reactivity to barbiturates. The results obtained with head-irradiated animals indicate that the reactivity of the central nervous system to barbiturates is not significantly changed. Therefore, x irradiation may produce some change in the detoxication process of barbiturates in the liver. Or, some biologically active substance might be released which contributes to the prolongation of the effect of barbiturates. Possibly 5-hydroxytryptamine liberated by x irradiation from intestine might contribute to the prolongation of the barbiturate hypnosis. (H.H.D.)

5789 THE EFFECT OF IONIZING RADIATION ON THE DEVELOPMENT OF PLANARIA. Mario Benazzi (Università, Pisa, Italy). Atti Accad. Nazl. Lincei. Rend., Classe Sci. Fis., Mat. Nat., 32: 26-9(Jan. 1962). (In Italian)

Data on the effects of x and Co^{60} radiations on the eggs and embryos of planaria are briefly summarized. The results show that at equal doses the effects of radiation vary with the stage of development. Doses between 1000 and 1500 r are tolerated by eggs within the first hour of deposition. Doses slightly higher appear to be lethal within the first hour. A high sensitivity of the neoblast to x radiation explains the results obtained with respect to the stage of development. (J.S.R.)

5790 ON OXIDATIVE METABOLISM IN STAPHYLOCOCCUS AUREUS AND A MUTANT OBTAINED BY ULTRAVIOLET IRRADIATION. V. N. Gershanovich, N. A. Palkina, and G. I. Kats (Tarasevich State Control Inst. for Medical and Biologic Preparation, USSR). Biochemistry (USSR) (English Transl.), 27: 89-97(July-Aug. 1962).

The oxidative metabolism of Staphylococcus aureus-209 (St-209) and its mutant Staphylococcus aureus-UV-3 (St-UV-3) was studied. The St-209 cells exhibited a drastic increase of oxygen uptake in the presence of glucose and oxidized also pyruvate, lactate, acetaldehyde, formaldehyde, ethanol, formic acid, oxalacetic acid, and malate. Under anaerobic conditions St-209 caused intensive decarboxylation of pyruvic and oxalacetic acid. Low concentrations of monoiodoacetate (0.2 mmol) completely inhibited glucose consumption and lactate accumulation by St-209. St-UV-3 did not show any increase in oxygen consumption in the presence of glucose but oxidized pyruvate, acetate, acetaldehyde, ethanol, oxalacetic acid, cis-aconitate, fumarate, succinate, and glyoxylate. Irregular malate and α-ketoglutarate oxidation was also noted. Under anaerobic conditions St-UV-3 only slightly decarboxylated pyruvic and oxalacetic acid. The Q_{CO_2}/Q_{O_2} coefficient was more than 2 for pyruvate oxidation by St-209 while with St-UV-3 it approached 1. The effect was followed up of arsenite, malonate, cyanide, and inorganic phosphate upon oxidation of some substrates. A discussion is presented of the pathways of oxidative transformations of respiratory substrates in St-209 and St-UV-3 as well as of the equivalency between the mutant and tumor tissue metabolism and of the possible mechanism of the effect of cancerostatic compounds upon St-UV-3 cells. (auth)

5791 POLYMERIZATION OF RIBOMONONUCLEOTIDES BY γ-RADIATION. Guillermo Contreras, Romilio Espejo, Elena Mery, Adela Ohlbaum, and José Tohá (Universidad Chile, Santiago and Instituto Bacteriologico Chile, Santiago). Biochim. Biophys. Acta, 61: 718-27(Nov. 26, 1962). (In English)

After γ irradiation ($0.9 - 18.0 \times 10^4$ r) of ribomononucleotides in aqueous solution a decrease in absorbancy at 260 mμ of at least two different components was observed. The decrease is an exponential function of the dose. Alkaline and enzymic hydrolysis with RNAase or phosphodiesterase of the irradiated samples produced an hyperchromic effect. Paper chromatography showed that the irradiated product has a lower R_F than the mononucleotides. After alkaline or phosphodiesterase hydrolysis the R_F again approached that of the controls. The irradiated samples were chromatographed on a DEAE-cellulose column. Stronger anions (polymers) with a nucleic acid-like absorption spectrum were separated from the original mononucleotides by elution with increasing concentrations of NH_4HCO_3. The polymers formed by radiation decreased or disappeared if the samples were incubated with alkali or enzymes before adsorption on the column. There was a correlation between the size of the polymers formed and the dose of γ rays used. Irradiated samples excited at 310 mμ had a fluorescence at 400 mμ, not shown by the mononucleotides, directly related to the dose and decreasing after alkaline hydrolysis. Irradiated deoxyribomononucleotides (14.4×10^4 r) showed a decrease in absorbancy at 260 mμ, which was partially reversed after incubation with deoxyribonuclease. The polymerization through phosphodiester bonds after γ radiation of ribomononucleotides is discussed. (auth)

5792 EFFECT OF X-IRRADIATION ON THE HEPATIC SYNTHESIS OF FATTY ACIDS AND CHOLESTEROL. S. V. Pande, A. Ramaiah, and T. A. Venkitasubramanian (Univ. of Delhi). Biochim. Biophys. Acta, 65: 516-18(Dec. 17, 1962). (In English)

The effects of x radiation on the hepatic synthesis of fatty acids and cholesterol that accompany starvation were studied. Following irradiation, 5 ml of glucose solution was given to irradiated and nonirradiated albino rats until the animals became glycosuric. Irradiated animals developed glycosuria 14-16 hr after irradiation. Before being killed, the rats were injected with sodium ($I-C^{14}$) acetate. There

was a tendency for animals force fed with glucose to incorporate (I-C^{14}) acetate into fatty acids and cholesterol to a greater extent than animals fed a stock diet ad libitum. It is believed possible that decreases in the activities of the enzymes synthesizing fatty acids and cholesterol and alterations in the regulatory factors that accompany starvation are prevented as a result of irradiation. (P.C.H.)

5793 EFFECTS OF DECAY OF INCORPORATED H^3-THYMIDINE ON BACTERIA. Stanley Person and Hazel Leah Lewis (Univ. of California, Los Angeles). Biophys. J., 2: 451-63(Nov. 1962).

The killing efficiency due to the decay of incorporated H^3-thymidine in three mutants of E. coli strain 15: 15_T-, 15_{T-1}-, and 15_{T-U}- was determined. This efficiency is comparable to that previously determined by others for P^{32} decay. The killing efficiency has been determined as a function of H^3-thymidine specific activity, storage media, and storage temperature. We have observed a latent killing effect that causes lethality under certain conditions. The kinetics of latent killing have been examined at several temperatures. Finally, mutation production induced by H^3-thymidine decays was shown to occur. The results are consistent with the idea that inactivation and mutations may be caused by a process in the nuclear transmutation that is not associated with β-particle ionization damage. (auth)

5794 HISTOLOGIC ASPECTS OF OCULAR HYPERTONIA INDUCED BY ROENTGEN IRRADIATION. A. Cecio and F. Menna (Università, Naples). Boll. Soc. Ital. Biol. Sper., 37: 603-5(July 15, 1961).

Elevated intraocular pressure sometimes follows x-ray therapy directed toward the eye. To investigate the pathogenesis of this disorder, adult guinea pigs were given a single 1400 r dose, either over the whole body or directed toward the iridocorneal angle. Local irradiation resulted in detachment of corneal epithelium, interruption of the normal trabecular structure of the ciliary process, and confluence of the lymphatic lacunae of Fontana. At a later stage, blood vessels and ciliary muscle show injury. After whole-body irradiation similar changes were seen in the ciliary body, which incurred more injury than other ocular structures. It is suggested that the primary damage to the eye resulting in increased intraocular pressure occurs here. Since the ciliary body is responsible for formation of ocular fluid and regulation of its exchange, disruption of its function by irradiation injury may result in increased pressure of this fluid. (H.H.D.)

5795 CONSIDERATIONS OF THE HISTOLOGIC AND HISTOCHEMICAL INJURY INDUCED BY TOTAL ROENTGEN IRRADIATION IN THE FEMALE GENITAL ORGANS OF PUBERTAL AND PREPUBERTAL MICE. A. Cecio and G. Cerasuolo (Università, Naples). Boll. Soc. Ital. Biol. Sper., 37: 605-7(July 15, 1961).

Changes in uterus and ovaries were studied in mice exposed to 700 r whole-body irradiation. Endometrial glands showed an increase in mitotic figures after irradiation and somewhat decreased numbers of cells although histochemical tests for polysaccharides and ribonucleic acid (RNA) and deoxyribonucleic acid (DNA) were intensified. The results were similar in adult and immature mice. In ovary, irradiation caused degeneration of follicles with separation of granulosa cells, which was followed by hyperplasia during the reparative phase. Here also polysaccharides were increased in amounts, especially in the zona pellucida of the oocytes. Epithelium of Fallopian tube also showed increased histochemical reactions for polysaccharides, RNA, and DNA. Most of these changes were evident within 24 hr after irradiation; they increased in intensity up to the 2nd day, then tended to decrease. (H.H.D.)

5796 MODIFICATIONS OF THE SEMINAL VESICLE OF CASTRATE ADULT RATS IRRADIATED AND TREATED WITH TESTOSTERONE. G. Giannardi and E. Brizzi (Università, Florence). Boll. Soc. Ital. Biol. Sper., 37: 609-11(July 15, 1961).

Adult male rats castrated 2 months previously were irradiated in the suprapubic region with 1000 r and some animals were injected intramuscularly with 10 mg testosterone propionate 1 hr later. Seminal vesicles removed 7 and 15 days later were examined histologically. Only slight changes caused by radiation were noted after 7 days in the atrophic vesicles, in which the epithelium was low and the tunica propria acellular and fibrillar. After 15 days, radiation-induced changes were more severe in uninjected rats as shown by karyorrhexis and karyolysis of epithelial nuclei and polymorphic cells in the stroma. In vesicles stimulated by testosterone, few radiation changes were seen 7 days later, the cylindrical epithelial cells filled with granules being normal in appearance except for some with giant nuclei. After 15 days the glandular epithelium showed various signs of hyperfunction induced by testosterone and very little evidence of radiation injury. (H.H.D.)

5797 VARIATIONS IN THE FREQUENCY OF "DRUMSTICKS" IN THE RABBIT AFTER PANIRRADIATION. U. Bigozzi, P. Rossi Ferrini, P. Paoletti, and L. Ciampelli (Università, Florence). Boll. Soc. Ital. Biol. Sper., 37: 1274-8(Dec. 31, 1961).

Female rabbits were irradiated with a single dose of 300 r or with 200 r daily doses and changes in the number and morphology of circulating granulocytes were followed daily for 8 days. In the 1st group, the number of granulocytes fell to a minimum on the 3rd to 4th day then rose to a low maximum on the 8th day and declined again. The number of cells with drumstick-like nuclei showed inverse changes, becoming maximum on the 4th day and minimum on the 7th day. The number of medially segmented nuclei rose only slightly on the 3rd day, then fell. With lower x-ray doses the total number of cells fell more slowly, the number of drumstick forms rose less markedly, and the number of medially segmented forms rose to a greater extent than after the higher dose. These changes are interpreted in terms of the rate of maturation of granulocytes and their stage at release into the circulation from bone marrow. (H.H.D.)

5798 CHANGES IN THE MORPHOLOGY OF "DRUMSTICKS" IN THE RABBIT AFTER PANIRRADIATION. U. Bigozzi, P. Rossi Ferrini, P. Paoletti, and L. Ciampelli (Università, Florence). Boll. Soc. Ital. Biol. Sper., 37: 1278-81(Dec. 31, 1961).

The morphology of the nucleus of circulating granulocytes was examined daily for 13 days in the blood of female rabbits irradiated with 200 r. The length of drumstick-shaped nuclear segments rose slightly and progressively throughout this 13-day period. The length of these segments rose proportionally with the number of lobules per nuclei. It is suggested that these changes in nuclear morphology reflect changes in nuclear membrane structure caused by ionizing radiation. (H.H.D.)

5799 THROMBOELASTOGRAPHIC AND ELECTROPHORETIC STUDY OF IRRADIATED FIBRINOGEN. L. A. Cioffi (Università, Naples). Boll. Soc. Ital. Biol. Sper., 37: 1301-4(Dec. 31, 1961).

A 1.15% solution of bovine fibrinogen in Veranal buffer

(pH 8.6, ionic strength 0.1) was irradiated at a rate of 1844 r/min to total doses of 10,000, 50,000, and 80,000 r. Changes in its coagulability and electrophoretic behavior were then studied. After 80,000 r, coagulation of irradiated fibrinogen was significantly delayed, as shown by the thromboelastogram, but some impairment of coagulability was also noted after the lower doses too. The electrophoretic mobility was increased after irradiation in proportion to the dose, and in some instances the formation of a small amount of material of lower mobility was evident. (H.H.D.)

5800 IRRADIATION AS A CAUSE OF MASCULINIZATION IN SUBMAXILLARY GLANDS. C. C. Berdjis (U. S. Army Medical Unit, Fort Detrick, Md.). Brit. J. Exptl. Pathol., 42: 38-42(Feb. 1961).

Histopathologic changes were investigated in male and female rats ~1 yr after 500 r whole-body irradiation. Radiation masculinized the submaxillary glands of female rats, as was previously found in mice. Radiation affected both components of submaxillary glands, acini and tubules; more severe changes occurred in the female. The changes included: atrophy, with occluded acini in both sexes; tubular hypertrophy in females; and masculinization with acidophilic granules in the female. Most of the females developed radiation-induced hormone-secreting tumors such as granulosa-cell and masculinized tumors (arrhenoblastoma), in highly atrophic, nonfunctioning ovaries. The tumors seemed to be the cause of masculinization in submaxillary glands and kidneys of irradiated rats. Most of the changes showed the influence of hormonal imbalance related to ovarian injury. The degree of masculinization, as seen by epithelial cells with acidophilic granules, their height, and diameter, can be used as an index of hormonal imbalance in evaluating the ovarian function in rats and mice. (H.H.D.)

5801 EFFECT OF X IRRADIATION UPON THE DEVELOPMENT OF EXPERIMENTAL ALLERGIC ENCEPHALOMYELITIS IN GUINEA PIGS. E. J. Field (Royal Victoria Infirmary, Newcastle-upon-Tyne, Eng.). Brit. J. Exptl. Pathol., 42: 303-6(Aug. 1961).

Guinea pigs were irradiated with 150 to 900 r (whole-body) 18 hr before injection of human brain in adjuvant to induce experimental allergic encephalitis (EAE). Maximal inhibition of antibody response is usually found when whole-body x irradiation precedes antigen inoculation by 12 to 24 hr. Contrary to what was expected, 150 r irradiation enhanced the severity of EAE both as regards incidence and severity. There was no evidence that 150 r suppressed the immune mechanism in the guinea pig since skin sensitivity to the injected antigen was still developed. Failure of such treatment to prevent EAE cannot therefore be used as an argument against the allergic nature of the condition. Moreover, it is possible that other time relations between irradiation and inoculation may prove more effective than those observed. With 300 r the poor general condition of animals that survived made it very difficult to assess clinical signs of EAE. However, there was no marked worsening effect and the same findings applied to the few animals which survived 450 r. It seems possible then that in the relatively x-ray resistant guinea pig a dose of 150 r may be stimulatory while depressant doses are at the lethal or near lethal level. (H.H.D.)

5802 SECONDARY DISEASE AMONG LETHALLY IRRADIATED MICE RESTORED WITH HEMATOPOIETIC TISSUES FROM NORMAL OR ISO-IMMUNIZED FOREIGN MICE. J. F. Loutit and H. S. Micklem (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Brit. J. Exptl. Pathol., 43: 77-87(Feb. 1962).

Mice lethally irradiated and treated with foreign bone marrow frequently suffer from secondary disease. The clinical appearance, time of onset, and severity of this wasting disease vary with the donor tissue and the host. In 2 donor-host strain combinations (CBA → A; A → CBA) iso-immunization of the donor against antigens of the prospective host has little effect on the syndrome, while addition of spleen cells (normal or iso-immune) to the bone marrow inoculum markedly accelerates and aggravates it. In a 3rd combination (C3H → CBA), on the other hand, where donor and host are closely related, iso-immunization of the donor accelerates and aggravates the syndrome, while the addition of normal spleen to normal bone marrow actually reduced its incidence and results in better health and longer survival of the hosts. These results suggest that a graft-versus-host reaction in CBA mice treated with normal C3H bone marrow either does not occur or, if it does, is so slight as to lead to negligible damage. The symptoms of this secondary disease must have some other cause, which is largely removed by the injection of lymphoid cells. Secondary wasting disease in these animals may be caused by an inadequate lymphoid system and this in turn may be caused by an inadequate number or failure to mature of lymphoid precursors in the therapeutic bone marrow inoculum. Lymphoid inadequacy could produce secondary disease symptoms by making the chimera susceptible to chronic infections. The failure of normal C3H lymphoid cells to react against the CBA host, and their apparent ability to provide the chimera with an adequate tolerant lymphoid tissue may be due to only the most mature cells in the inoculum being able to give an immune reaction to the weak host antigens. These mature cells might die in the normal course of events before the induction period of the primary immune response against the host could be completed; where the donors were immunized against CBA antigens, and therefore no induction period in the irradiated hosts was necessary, there was a pronounced anti-host reaction. Thus, there are at least 2 causative factors which may operate in secondary disease: an inadequacy of the chimera's lymphoid system and a graft-versus-host immune reaction. The 1st factor may produce severe disease even in the absence of the 2nd. (H.H.D.)

5803 IRRADIATION AND LEUKEMIA. M. E. Wise (Oxford Univ.). Brit. Med. J., 2: 48-9(July 1, 1961).

The influence of prenatal diagnostic x rays on the incidence of leukemia was investigated by comparing the age of death of leukemic children, who were or were not irradiated in utero. The results showed that irradiated first-born children died of leukemia on an average of 4 months earlier than nonirradiated children. No such difference was found in the case of other malignancies. From the same survey it was previously suggested that in half of the leukemias who were irradiated in utero the initiating event was x rays. Therefore, it is suggested that, in the first-born at least, the crucial event occurs about 8 months later than the corresponding event for leukemias caused in other ways. Since most of the mothers were irradiated in the 8th or 9th month, this accords with the suggestion, made on other grounds, that most childhood leukemias are promoted within a few weeks of conception. (H.H.D.)

5804 THE CAUSE OF DEATH OF THE X-RAY MARTYRS AND AN ESTIMATION OF THE DOSES. Peter Kerley. Brit. Med. J., 2: 368-9(Aug. 5, 1961).

A survey is made of 149 documented cases of pioneer radiation workers. In 121, death was attributed to chronic

radiodermititis and secondary malignancy; 28 died from induced carcinoma, of which 20 had blood dyscrasias. Of these 20, 17 had aplastic anemia and 3 leukemia (chronic lymphatic leukemia in 1 case). Eleven other cases were recorded since 1930, bringing the total to 160 documented cases. Of these 11 cases, 3 had myeloid leukemia, 1 lymphatic leukemia, 1 lymphatic leukemia plus lung carcinoma, and 5 carcinomas from radiodermititis. Painful sequelae developed mainly from lymph-node involvement, and in some cases intense pain was experienced before widespread carcinoma appeared. In most cases the latent period lasted many years, but 1 radiologist dying of lymphatic leukemia had had 250 ketatoses and epitheliomas removed. Two living radiologists had received an estimated 2000 and 3000 r, respectively, to the body, and the author had received over 1000 r above the waist, with no apparent ill effects. (H.H.D.)

5805 VESICAL HEMORRHAGE AFTER MEGAVOLTAGE IRRADIATION. D. P. B. Turner (Newsham General Hospitals, Liverpool). Brit. Med. J., 2: 1462-6 (Dec. 2, 1961).

Four cases of persistent hemorrhage occurring after megavoltage irradiation (~5000 rad) for extensive bladder neoplasm are described. The complication after megavoltage therapy is regarded as an extremely serious condition; if it is not controlled by conservative measures within 2 to 3 weeks, total cystectomy should be considered, even if cystoscopy shows that the original tumor has almost completely disappeared. Cystoscopic diathermy is not practicable, and ligation of the internal iliac arteries is not effective. The bleeding, however, can usually be controlled by transvesical diathermy excision of the bleeding area. It is suggested that the hemorrhagic lesions induced in the bladder by irradiation may follow necrotizing arteriolitis, although this was not verified by biopsy studies. (H.H.D.)

5806 WHOLE BODY SCANNING IN MEDICINE. II. CLINICAL ASPECTS. W. J. K. Simpson, A. D. Rotenberg, and R. G. Baker (Univ. of Toronto). Can. Med. Assoc. J., 87: 371-7(Aug. 25, 1962).

Whole-body scans were conducted in 439 patients using I^{131}, Fe^{59}, Cu^{64}, Sr^{85}, Ca^{47}, or I^{131}-labeled 5-iododeoxyuridine. With I^{131}, functioning metastases were demonstrated in 11 of 26 patients with follicular or papillary thyroid cancer. Fe^{59} scans demonstrated extramedullary hematopoiesis in patients with polycythemia vera, myelofibrosis, and myelophthisic anemia. Cu^{64} studies showed abnormal concentration in the kidneys in 2 patients with Wilson's disease. Sr^{85} localized in bone metastases in at least 4 patients with malignant disease. Liver and kidney scans, using I^{131}-Rose Bengal and Hg^{203}-Neohydrin respectively, were useful in the management of patients suffering from malignant disease, renal hypertension, and certain other disorders. Results with the total-body scanner shows that it plays a valuable role in the investigation and management of patients with malignant disease. Its usefulness will increase with the finding of suitable labeled substances possessing a marked affinity for certain organs or tumor tissues. (H.H.D.)

5807 MODIFICATIONS OF THE COMPETENCE OF THE ECTODERM OF THE GASTRULA OF BATRACHIA AFTER IRRADIATION WITH X-RAYS. Maryse Reyss-Brion (Centre National de la Recherche Scientifique, Paris). Compt. Rend., 255: 1013-14(July 30, 1962). (In French)

After irradiation with x rays, the capacity of the ectodermic rudiments to form nervous tissues progressively disappears. The deuterencephalic and archencephalic structures disappear first; the spinocaudal structures retain longest the capacity to be differentiated. (tr-auth)

5808 INHIBITION OF CAUDAL REGENERATION BY X-IRRADIATION IN SYLLIS AMICA (ANELIDE POLYCHETE). Benoni Boilly (Faculté des Sciences, Lille, France). Comp. Rend., 255: 1414-16(Sept. 10, 1962). (In French)

The absence of caudal regeneration in the anterior section of Syllis amica Quatrefages exposed to whole-body or regional x radiation suggests that the regenerating cells are located in the segment preceding the section. (tr-auth)

5809 BIOSYNTHESIS OF CAROTENOIDS BY RHODOTORULA MUCILAGINOSA; STUDY OF A MUTANT OBTAINED BY THE ACTION OF X RAYS. F. Kayser and J. Villoutreix (Faculte de Pharmacie, Nancy, France). Compt. Rend. Soc. Biol., 155: 1094-5(1961).

A radiation-induced mutant was produced from this yeast as follows. Yeast cells were centrifuged from a 24-hr culture and suspended in 0.067M KH_2PO_4 buffer (5000 cells/ml.). The suspension was irradiated at a distance of 15 cm from a tube operated at 40 kv and 10 ma. Mutants were detected in subcultures of the irradiated yeast. One mutant produced the same amount of total carotenoid pigment at the parent strain but a different proportion of individual pigments. The respective concentrations of carotene derivatives extracted from the mutant and parent yeast were: torularhodine 70.6, 97.8 (μg/g yeast); torulene 3.4, 15.6; γ-carotene 7.0, 1.3; pigment X (traces in both strains); and β-carotene 54.6, 5.5. These findings are compatible with the hypothesis that torulene is derived from γ-carotene by methoxylation, but the possibility of transformation of β-carotene to torulene cannot be excluded. (H.H.D.)

5810 PRODUCTION BY THE FETUS AND LOCALIZATION OF CELLS CONFERRING RESTORATIVE ACTIVITY ON IRRADIATED MICE. N. S. Wolf and J. F. Duplan (Institut du Radium, Paris). Compt. Rend. Soc. Biol., 155: 1895-7(1961).

Various tissues were removed from mouse fetuses of different ages and injected into isologous adult mice exposed to lethal doses of x rays (LD_{100}, or 800 r). The 30-day mortality was decreased from 100% to 31% by injection of 5×10^6 spleen cells from the 18-day fetus, and to 29% with the same number of liver + spleen cells from 14- or 15-day fetuses. Other fetal tissues had only negligible restorative effects on the bone marrow of irradiated recipients. Cells taken from the whole 15-day fetus after removal of spleen and liver decreased 30-day mortality to 90%. It is possible that this whole-fetus inoculum contained circulating cells that originated from spleen or liver; at this age the fetus has no bone-marrow hematopoietic cells. (H.H.D.)

5811 STUDIES ON THE PEROXIDASES OF GRANULOCYTES AFTER IRRADIATION AND IN LEUKEMIAS. D. Raskovic (Inst. Boris Kidric, Belgrade). Compt. Rend. Soc. Biol., 155: 2049-50(1961).

By a cytochemical method applied to smears of rat blood, no change in peroxidase activity of granulocytes could be detected after sublethal irradiation with 300 r. This finding is in contrast to a previous report claiming inactivation of peroxidase in granulocytes after x irradiation. By a chemical method, no change in peroxidase activity could be found in whole blood after irradiation. However, in leukemias granulocyte peroxidase activity is increased, moderately in myeloid and markedly in lymphoid leukemia. An intermediate rise was noted in basophil leukemia. Lipid content of granulocytes is also increased in leukemia. (H.H.D.)

5812 CONTRIBUTION TO THE EXPERIMENTAL RADIOBIOLOGY OF TUMORS; INFLUENCE OF IRRADIATED CELLS ON VIABLE CELLS IN THE ATYPICAL GUÉRIN T8 EPITHELIOMA IN THE WISTAR RAT. J. Jacquet, G. Letourneur, P. Jacob, and S. Abbattucci (Faculté des Sciences, Caen, France). Compt. Rend. Soc. Biol., 155: 1248-51(Dec. 18, 1961).

The x-ray dose necessary to kill cells of this relatively radiosensitive tumor was investigated. Lymph nodes from rats with metastatic cancer were irradiated with 1000 to 5000 r after removal and before transplantation into recipients. Without irradiation, 90% of the lymph nodes conveyed cancer to the recipients. Irradiation of the nodes with 1000 r reduced this to 2%, 3000 r to 0.5%, and 5000 r to 0.0%. Thus, the highest dose appears to destroy all of the epitheloma cells. In a 2nd experiment, tumor cells irradiated with 5000 r were mixed with viable, nonirradiated tumor cells and injected subcutaneously into recipient rats. The incidence of cancer in these rats was only 33% compared with 92% in rats injected with viable, nonirradiated tumor cells. A lesser degree or protection was afforded when both types of cells were injected at different sites; cancer incidence in this case was 71%. The possibility that the irradiated cells may be more antigenic and confer immunity on the host is suggested. (H.H.D.)

5813 INVESTIGATION OF THE PROBLEM OF THE IMMEDIATE DETECTION OF THE BIOLOGICAL ACTION OF ROENTGEN IRRADIATION. [PART] II. R. Schuppli and H. H. Wagener (Dermatologische Universitätsklinik, Basel). Dermatologica, 122: 30-6(1961). (In German)

When rat or guinea pig skin was irradiated with 5000 to 10,000 r, an immediate drop in conductivity of the skin could be detected. A 2nd irradiation 5 min later produced another drop in conductivity which was preceded by a slight transient rise in conductivity in some cases. In rabbit skin this fall in conductivity after irradiation was diminished by one-third if the skin was stretched during irradiation. To determine whether this phenomenon results from a local effect of radiation in skin or from blood-borne agents generated by radiation, changes in conductivity were measured in shielded skin while the rest of the animal was irradiated with 10,000 r. Conductivity fell slightly in shielded skin, but much more rapidly in unshielded skin, showing the predominance of locally induced changes. It is suggested that conductivity changes are a direct physical effect of irradiation, acting on some tissue constituent, possibly mucopolysaccharides. (H.H.D.)

5814 IMMUNOPATHOLOGICAL PROBLEMS OF ORGAN TRANSPLANTATION. F. Scheiffarth (Medizinische Universitätsklinik, Erlangen, Ger.). Deut. Med. Wochschr., 86: 1329-31(July 14, 1961).

A review of animal experiments showed that heterologous and homologous bone-marrow and tissue transplants were well tolerated if the immunological response of the recipients was destroyed by x radiation or cytostatic agents. The secondary syndrome which followed bone-marrow transplants was amenable to treatment with folic acid antagonists and corticosteroids. (H.H.D.)

5815 UROLOGIC COMPLICATIONS IN THE TREATMENT OF CERVICAL CARCINOMA. O. Kaeser and F. A. Iklé (Frauenklinik, Kantonsspitals, St. Gallen, Switzerland). Deut. Med. Wochschr., 86: 2465-72(Dec. 22, 1961).

Injury to the urinary tract during radiotherapy of uterine cancer is discussed and clinical results are reported. The injury depends on the absorbed dose and the tolerance of the tissues, neither of which was readily estimated. Direct measurements in the bladder during radium therapy showed large individual variations. Tissue tolerance also varied widely even for the same histologic types; intestinal mucosa was more sensitive than urinary bladder epithelium. Tissue tolerance was raised by giving fractionated radiation doses. Prevention of infection also raised tissue tolerance. The dose tolerated by the urinary bladder is considered to be 6000 to 8000 r, which was higher than that tolerated by the rectum. Radiation damage to the urinary tract may not be manifested for months or years, and late effects are often not preceded by early damage, which is clinically evident. (H.H.D.)

5816 ROENTGEN DIAGNOSIS AND INCIDENCE OF LEUKEMIA. Gerhard Neumann (Städtische Gesundheitsamt, Stuttgart, Ger.). Deut. Med. Wochschr., 87: 90-4 (Jan. 12, 1962).

From 1954 to 1960, 10 fatal cases of leukemia were recorded in Stuttgart among tuberculous patients over 14 yr of age, in a sample equivalent to 91,549 person-year. In contrast to these 10 cases, 5.86 cases of fatal leukemia were recorded in a corresponding sample of the general population of Stuttgart in the same period, or 233 cases in the total population. Leukemia in the tuberculous patients, who were presumably exposed to more frequent chest roentgenography than control subjects, was in 1 case of the chronic myeloid type, 4 of the acute myeloid type, and 5 of the lumphoid type. Only 2 cases were under 50 yr of age and the sex distribution was 5:5. In none of the 10 cases was radiation exposure excessive, in fact, case records showed that their exposure was slightly lower than for the whole sample of tuberculous subjects. In view of this fact and because the incidence of leukemia is not statistically significantly greater in these subjects than in the general population, thoracic diagnostic radiography did not appear to favor development of leukemia in these subjects. (H.H.D.)

5817 THE EFFECT OF IONIZING RADIATION ON GONAD STIMULATION OF THE MOUSE OVARY. L. A. Kashchenko (Central Research Inst. of Medicinal Radiology, USSR). Doklady Akad. Nauk SSSR, 146: 1430-3(Oct. 21, 1962). (In Russian)

The effect of radiation on follicle growth in the ovary can be followed by administering a sterilizing dose of 80 to 160 r and examining the ovary 14 to 15 days after the irradiation, when some gonadotrophic reaction can still be observed. The mice were divided into three control groups and one experimental group. The 1st control group was left untreated. The 2nd control group was subjected to irradiation only. The 3rd control group was given two subcutaneous injections of prolan (30 mouse units per injection) separated by an interval of one week, and was not irradiated. The 4th experimental group was given a sterilizing x-ray dose of 80 to 160 r, and was injected with prolan on the 14th to 15th day after irradiation. The mice were subjected to autopsy directly after injection of the prolan, and 96 to 120 hours after injection in order to observe the gonadotrophic reaction. The average weight of an ovary was 3.5 mg, and the injection of prolan increased the weight to 8 mg. The irradiated ovary increased in weight to 5 mg after prolan stimulation, but substantial differences in the response of normal and irradiated ovaries were noted by microscopic study. Follicles in the early stages of growth were completely absent. It appeared that radiation had caused significant damage to the mechanism of ovulation. No follicles in the pre-ovulation stage could be detected. The embryonic epithelium lost its ability to generate primordial follicles. The large multi-layered follicles gave a gonadotrophic reaction, but this reaction was pathological in nature, be-

cause no signs of ovulation could be detected. It is possible that radiation causes damage to some ferment system which controls ovulation. (TTT).

5818 CLINICAL EXPERIMENTAL STUDIES ON THE THROMBOTIC DISORDER ARISING FROM GYNECOLOGIC RADIUM TREATMENT. H. Ludwig (Universitäts-Frauenklinik Munich, Ger.). Gebartsh. Frauenheilk., 22: 1121-3(Oct. 1962).

Thrombotic complications were encountered in 64 out of 978 patients who were treated by intravaginal or intrauterine Ra implantation. In 14 of these 64 cases, massive pulmonary emboli were found, resulting in death in 3 cases. These thrombotic complications occurred in spite of the fact that the patients were mobilized within 24 hr of radiation therapy, and they usually appeared within the 1st 48 hr after therapy. To investigate the origin of the apparently radiation-induced clotting disorder, thromboelastograms were conducted in 50 Ra-treated patients. A shortening of clotting time was noted as early as the 4th postirradiation hr and this was accompanied by a slight fall in the platelet count and increase in clot retraction time. Fibrinogen level in plasma rose slightly during the 25-hr implanation period, during which 2000 mg-hr Ra was administered. Later, platelet count and clotting time increased and retraction time decreased. It is suggested that this thrombotic diathesis may arise from radiation damage of platelets and release of thrombokinase. Release of thrombokinase from tumor tissue, mobilization of fibrinogen, and nonradiation factors may also be involved. As a prophylactic measure it is recommended that heparin or synthetic heparinoids (e.g., 40,000 to 50,000 units Liquemin) be administered intravenously before Ra therapy. (H.H.D.)

5819 DETERMINATION OF DOSAGE DURING IRRADIATION OF UTERINE CARCINOMA IN RELATION TO POSSIBLE RECURRENCE AND UROLOGIC COMPLICATIONS. (PRELIMINARY REPORT). H.-J. Spechter (Universitäts-Frauenklinik Tübingen, Ger.). Geburtsh. Frauenheilk., 22: 1126-30(Oct. 1962).

Observations were made on 210 patients with uterine cancer treated with Ra or roentgen therapy between 1957 and 1959. Of 168 cases of cervical cancer, 27 died and 20 others showed recurrence of the cancer, while 12 developed hydronephrosis. In the dose range 4000 to 6000 r, no correlation was found between dose and recurrence. The side on which hydronephrosis developed was correlated with the site of Ra implantation, but could not be closely correlated with the dose to the corresponding ureter. In several cases the calculated doses during Ra therapy were checked by measurements made during laparotomy. (H.H.D.)

5820 ON THE PROPHYLAXIS OF RADIATION-CONDITIONED HYDRONEPHROSIS (CLINICAL AND ANIMAL EXPERIMENTAL STUDIES). H. Muth and C. Legerlotz (Universitäts-Frauenklinik Münster i. Westf., Ger.). Geburtsh. Frauenheilk., 22: 1133-7(Oct. 1962).

Means of preventing hydronephrosis, developing from injury to the ureter during radiotherapy of gynecologic carcinoma, were investigated. These studies were based on previous observations that cortisone tended to reduce the incidence of ureteral strictures following irradiation of cervical carcinoma. Female rats were irradiated with 300 r, delivered to a 2×4.5 cm abdominal area, in repeated doses to give a total of 4500 r. The animals were injected intramuscularly with 0.5 mg of a crystalline suspension of prednisolone every week during and after irradiation, and control animals were treated with follicle-stimulating hormone (FSH). Pyelonephritis developed in 44% of FSH-treated animals compared with only 18% in prednisolone-treated rats; severe ureteral sclerosis was found in 36 and 20%; and histological detectable hydronephrosis was seen in 80 and 0%, respectively. It was concluded that this anti-inflammatory steroid inhibits development of the 2 factors which appear most responsible for radiation-induced hydronephrosis, namely, ascending pyelonephritis and ureteral sclerosis. This was confirmed in human subjects. In 50 women undergoing radiation treatment of uterine carcinoma, administration of a total dose of 500 mg prednisolone over a 3-month period completely prevented hydronephrosis, whereas this complication arose in 10% of women who did not receive this steroid. (H.H.D.)

5821 CHANGES OF CHEMICAL INDICES ON THE ALIMENTARY FATS UNDER THE ACTION OF IONIZING RADIATIONS. A. A. Fomin (Central Inst. for Graduate Work In Medicine, Moscow). Gigiena i Sanit., 27: No. 3, 34-9(May 1962). (In Russian)

Certain fats were irradiated in a cobalt installation with doses of 100,000, 700,000 and 1,500,000 r in an atmosphere of nitrogen or air with the addition of certain antioxidants. After irradiation the fats were stored in the presence or absence of air and at different temperature levels. The fats were examined at different periods after irradiation by organoleptic and physicochemical methods. A method of quantitative estimation of epihydrine alderhyde by means of a photoelectric colorimeter was elaborated. The irradiation of fats stimulated oxidation processes; the peroxide number was increased. However, irradiation in an atmosphere of nitrogen with the addition of an antioxidant inhibited the oxidation process. The fats stored at low temperature contained less peroxides. (auth)

5822 THE EFFECT OF COMBINED CONTINUOUS ADMINISTRATION OF RADIOACTIVE STRONTIUM AND OF FLUORINE TRACE SUBSTANCE ON HEMOPOIESIS IN RATS. V. A. Knizhnikov, Yu. D. Balika, and P. F. Bugryshev. Gigiena i Sanit., 27: No. 7, 8-11(July 1962). (In Russian)

The effect produced on hemopoiesis by the ingestion of water containing 1.5–15 mg/l of a trace element-fluorine and the joint effect produced by fluorine and Sr^{90}, administered to rats every other day in a dose of 0.01 microcurie, were studied in 62 rats. The investigated doses of fluorine and strontium-90 were found to affect the blood system. A fall in the content of the youngest forms in the white part of the bone marrow was noted when the concentration of fluorine equalled 15 mg/l. With a combined administration of fluorine and Sr^{90} no summation of their effect was noted. On the contrary, water containing 1.5 mg/l of fluorine contributed to the improvement of the investigated hemopoiesis indexes. (auth)

5823 A FLUORESCENT METHOD OF ANALYZING THE PERIPHERAL BLOOD IN CHRONIC ACTION OF SMALL DOSES OF IONIZING RADIATIONS. I. A. Gribova and E. A. Solovieva (Inst. of Labor, Hygiene and Occupational Disease, USSR). Gigiena i Sanit., 27: No. 8, 61-3 (Aug. 1962).

The efficiency of luminescence microscopy (with chromium fluorine-acriorange) in the early diagnostics of radiation injury in personnel exposed to chronic irradiation was discussed. Tests with personnel exposed to higher than permissible doses showed a greater number of yellow and orange nuclei than personnel exposed to smaller doses. (R.V.J.)

5824 GROWTH OF ASCITES TUMORS IN MICE INJECTED WITH X-IRRADIATED CELLS BY DIFFERENT ROUTES AND IN DIFFERENT DOSES. John R. Mitchell

and David M. Donaldson (Yale Univ., New Haven). Growth, 25: 367-75(Dec. 1961).

Studies were made on the growth of Ehrlich's tumor after lethally x irradiated ascitic cells were injected by different routes and in different doses. Susceptible animals, after receiving intraperitoneal inoculations of lethally x-irradiated (10000 r) ascites carcinoma cells, became resistant to later intraperitoneal and subcutaneous injections of viable tumor cells. When x-irradiated cells were given after the subcutaneous implantation of viable tumor cells, rejection of the tumor occurred. X-irradiated cells, when injected after an intraperitoneal transplant, stimulated tumor growth rather than inhibiting it. A slight degree of passive protection was afforded by treatment with serum obtained from immunized mice. Transfer of peritoneal cells from immunized to suceptible mice failed to protect from subsequent tumor grafts. When the intravenous route was used, no distinction was made between the lethally damaged x-irradiated cells and the viable tumor cells. It was postulated that the viable cells were soon damaged by the host and immunity responses from systemic effects occurred. There was evidence that an immune reaction was involved. That the tumor bed was the site of the immune reaction was found in animals with grafts implanted into the brain and into the anterior chamber of the eye. These sites are isolated from the reticuloendothelial system, and rejection did not occur as in animals with subcutaneous implants. (H.H.D.)

5825 ON THE INFLUENCE OF VARIOUS ROENTGEN IRRADIATION DOSES ON THE FATTY ACID COMPOSITION OF SKIN LIPIDS. H. Wagner, O. Wagner, and K. Bernhard (Universität, Basel). Helv. Physiol. Pharmacol. Acta, 19: C113-14(Dec. 1961). (In German)

The skin of rats was locally irradiated with doses of 200, 500, 1000, 2000, and 4000 r. The rats had been maintained on a diet containing sunflower seed oil in order to induce a higher degree of unsaturation of body fat. After 4 weeks, determinations were made of the linoleic acid (an unsaturated fatty acid) content of lipids in the skin and subcutaneous tissue of irradiated and nonirradiated areas. During this 4-week period the rats were maintained on a fat-free diet. In irradiated skin a linear relation was found between linoleic acid content and the logarithm of the x-ray dose. The percentage of linoleic acid rose from 12.8 at 200 r to 20.9 at 4000 r. No such relation was found in irradiated subcutaneous tissue or in nonirradiated tissues. It is suggested that subcutaneous tissue served as a depot for unsaturated fatty acids incorporated into skin fat after irradiation, which caused the proliferation of repair tissue. (H.H.D.)

5826 CHANGES IN PLASMA-IRON CONCENTRATION IN IRRADIATED ANIMALS. Laszlo Sztanyik and Erika Mandi. Honvedorvos, 14: 228-35(July-Sept. 1962).

In rabbits irradiated with sublethal and lethal doses, the concentration of plasma iron raised after 24 hours. In the early stages the average rise was proportional to the dose received. Several factors may play a role in the reaction, but it seems that the decisive factor is the disturbance in the erythropoetic function of the bone marrow and the related decrease in iron utilization for hemoglobin synthesis. In the early stages of radiation injury the determination of plasma-iron concentration may be of diagnostic significance in addition to other hematological tests. (OTS)

5827 THE EFFECTS OF LOW DOSES OF GAMMA RADIATION ON PLANT YIELDS. H. J. M. Bowen, P. A. Cawse, and S. R. Smith (Wantage Research Lab., Berks, Eng.). Intern. J. Appl. Radiation Isotopes, 13: 487-92 (Sept. 1962). (In English)

The effects of low doses of gamma radiation from Co^{60} were tested on dormant seeds of flax, radish, and cabbage, and on young plants of flax, cabbage, lettuce, clover, duckweed, and pine. Fresh or dry weights were taken as a measure of yield at harvest. Only in the case of pine seedlings was significant stimulation noticed: this occurred in the dose range 2 to 6 rad after 9 months' growth. (auth)

5828 STUDIES ON THE METABOLISM OF MUCOPOLYSACCHARIDES AND POLYSACCHARIDES ASSOCIATED WITH COLLAGEN AFTER WHOLE-BODY X-IRRADIATION. G. B. Gerber, G. Gerber, K. I. Altman, and L. H. Hempelmann (Univ. of Rochester, N. Y.). Intern. J. Radiation Biol., 5: 427-31(Sept. 1962). (In English)

Rats were injected with sulfate-S^{35} and/or glucose-U-C^{14}, were exposed to x rays two or three days later, and were sacrificed two or three days after exposure. Sulfate and hexosamine were isolated from mucopolysaccharides of bone and skin, and hexosamine was also isolated from soluble and insoluble collagen of skin and from total collagen of bone. On the basis of the changes in the specific activity of these compounds after irradiation, it was concluded that the replacement of mucopolysaccharides is partially inhibited after x irradiation. The changes in the specific activity of hexosamine associated with collagen were not marked, but exhibited a trend similar to that observed previously in amino-acid residues of collagen from irradiated rats. (auth)

5829 THE X-RAY INACTIVATION OF THE LYSINE DECARBOXYLASE IN BACTERIUM CADAVERIS. Helmut Pauly (Max-Planck-Institut für Biophysik, Frankfurt am Main). Intern. J. Radiation Biol., 5: 433-7(Sept. 1962). (In English)

The radiosensitivity of the lysine decarboxylase in Bacterium cadaveris was studied. The activity of the enzyme after irradiation within the living cell was determined by a dose-dependent shift of the pH-activity curve as well as an exponential x-ray inactivation. (auth)

5830 THE RADIOSENSITIVITY OF THE PROCESSES OF DNA-SYNTHESIS IN MOUSE SPLEEN. G. H. Huntley and L. G. Lajtha (Churchill Hospital, Oxford). Intern. J. Radiation Biol., 5: 447-60(Sept. 1962). (In English)

The effect of different doses of x rays on DNA-synthesis in mouse-spleen lymphocytes during the synthetic period was studied in vivo and in vitro. DNA-synthesis was measured by the incorporation of H^3- or C^{14}-thymidine. The data confirmed that the radiosensitivity is markedly greater in vivo. The discrepancy was not readily remedied by fortification of the incubation medium by energy-producing substances, and the increased depression did not seem to be due to the release of DNA-metabolites or an inhibitor of DNA-synthesis by the intact spleen. A triphasic response for lymphocytes in vivo is postulated to explain the greater radiosensitivity. (auth)

5831 SENSITIVITY AND PROTECTION OF MOUSE BONE-MARROW CELLS X-IRRADIATED IN VITRO. L. H. Smith (Oak Ridge National Lab., Tenn.) and O. Vos. Intern. J. Radiation Biol., 5: 461-70(Sept. 1962). (In English)

The 30-day survival of mice exposed to a lethal dose (798 r) of x rays was a function of the number of isologous bone-marrow cells injected. From this calibration curve it was possible to determine the surviving fraction in a suspension of marrow cells irradiated in vitro. The in vitro radiation response of such suspensions could be represented by a typical exponential survival curve the linear part of

which indicated a D_{37} of 84 r and an extrapolation number of 2.5. Cysteine, S,2-aminoethylisothiuronium chloride, and anoxia protected marrow cells irradiated in vitro and gave dose reduction factors ranging from 1.7 to 2.1. Noradrenaline did not protect the cells. (auth)

5832 MODIFICATION OF RADIATION-DAMAGE BY ENVIRONMENTAL FACTORS, AS DEMONSTRATED BY INCORPORATION OF ^{32}P INTO NUCLEIC ACIDS OF γ-IRRADIATED EHRLICH ASCITES-TUMOUR CELLS. Yuong-Tchel Tchoe, Yasuhiko Takamori, Mitsuhiko Akaboshi, and Ichijiro Honjo (Osaka Univ.). Intern J. Radiation Biol., 5: 493-507(Sept. 1962). (In English)

The incorporation of P^{32} into nucleic acids was investigated with Ehrlich ascites-tumor cells, which had been irradiated with γ-radiation in the frozen state. Considerable activity of incorporation was retained after rapid freezing, being practically unaffected during storage for 24 hours at –196°C. Incorporation into DNA was reduced by 24% after 1000 r γ-irradiation in vitro in oxygen at room temperature. The damage was considerably diminished when irradiated in nitrogen. The oxygenated sample irradiated at –196°C and thawed within several minutes showed a similar or more enhanced degree of inhibition of incorporation than at the liquid state. However, the radiation-induced lesion was almost effaced, if not completely, when storage at –196°C was prolonged to 1 hour or more. The nitrogenated sample showed always the lower radiosensitivity, independent of the period of post-irradiation storage. These facts suggest that indirect action mediated by diffusion of radiation-induced active species is mainly operative in the biochemical lesion. Active species seemed to decay, i.e. become inactive, gradually at –196°C. (auth)

5833 THE RELATIONSHIP BETWEEN THE MAGNITUDE OF THE EFFECT AND THE OXYGEN-CONCENTRATION IN IRRADIATION EXPERIMENTS ON TRADESCANTIA POLLEN-TUBE CHROMOSOMES. A. A. Van Soestbergen (National Defence Research Organization T.N.O., Rijswijk (Z. H.), Netherlands). Intern. J. Radiation Biol., 5: 513-17 (Sept. 1962). (In English)

An equation is presented that describes the relation between the magnitude of the effect and oxygen concentration in irradiation experiments on Tradescantia pollen-tube chromosomes. Applications in studies on the radiosensitivity of microorganisms and chromosomes are discussed. (C.H.)

5834 IONIZING RADIATION AND THE EAR. Steven J. Borsanyi and Cyrus L. Blanchard (Univ. of Maryland, Baltimore). J. Am. Med. Assoc., 181: 958-61(Sept. 15, 1962).

The effects of ionizing radiation on the ears of 100 patients were studied in the course of treatment of malignant head and neck tumors by teleradiation using Co^{60}. Early changes consisted of radiation otitis media and a transient vasculitis of the vessels of the inner ear, resulting in hearing loss, tinnitus, and temporary recruitment. While no permanent changes were detected microscopically shortly after the completion of radiation in the cochlea or labyrinth, late changes sometimes occurred in the temporal bone as a result of an obliterating endarteritis. The late changes were separate entities caused primarily by obliterating endarteritis and alterations in the collagen. Radiation affected the hearing of individuals selectively. When hearing threshold shift did occur, the shift was not great. The 4000 cps frequency showed a greater deficit in hearing capacity during the tests, while the area least affected appeared to be in the region of 2000 cps. The shift in speech reception was not significant and it was correlated with the over-all change in response to pure tones. Discrimination did not appear to be affected. Proper shielding of the ear with lead during radiation, when possible, eliminated most complications. (H.H.D.)

5835 AN ELECTRON MICROSCOPE STUDY OF RADIATION DAMAGE IN THE MOUSE OOCYTE. Donald F. Parsons (Oak Ridge National Lab., Tenn.) J. Cell Biol., 14: 31-48(1962).

Cytological changes occurring in young oocytes of the mouse, following whole-body x irradiation, were examined by light and electron microscopy. Two minutes after a dose of 200 r, a drop occurs in the number of mitochondria per oocyte. The normal number of mitochondria is restored in the next few minutes. Five to 6 hours after a dose of 7 r, and 30 to 45 minutes following a dose of 200 r, all the oocytes are markedly contracted. In the next 2 hours (at a dose of 7 r), some cells shrink further and become pycnotic, while others expand and show signs of karyolysis. Of the expanded cells, some (about 50 per cent of total young oocytes) become morphologically normal. In both pycnotic and karyolytic nuclei, the nucleolus was contracted but without loss of its fibrillar structure. The contracted nucleolus appeared similar to those seen in some nearly mature normal oocytes (these oocytes have a high natural death rate). No other cell type in the ovary was affected by doses of x-rays up to 200 r. Observations on the nucleus of the normal oocyte are included. In the dictyate state of meiotic prophase the chromosomes were dispersed into bundles of 100 A microfibrils. The main component of the nucleolus was found to be tightly coiled fibrils of 60 to 100 A, which appear to have a close relationship with the microfibrils of the chromosomes. (auth)

5836 ANOMALIES IN CHROMOSOMES OF THE CIRCULATING LEUKOCYTES IN MAN FOLLOWING LARGE DOSES OF RADIOACTIVE IODINE. M. Neal MacIntyre and Brown M. Dobyns (Cleveland Metropolitan General Hospital). J. Clin. Endocrinol. Metab., 22: 1171-81(Dec. 1962).

Observations made on a single patient who had thyroidal carcinoma with functioning metastases and who was given a therapeutic dose of 167 mC of I^{131} are reported. At frequent intervals during the first 24 hr, and less frequently thereafter for 14 days, the concentration of radioactivity and the leukocyte and differential counts were determined. Simultaneously, cultures of leukocytes were made as a source of chromosomal preparations. Spreads of chromosomes from many individual cells of each culture were counted and analyzed. Numerous anomalies of structure and number were found. In most instances the abnormality was a chromosomal number less than the normal of 46, but in some instances the counts exceeded the normal. An occasional 4n nucleus was seen. Chromosomal breakage and dicentric forms occurred. The maximal frequency of anomalies occurred during the period of 3 to 12 hr after I^{131} administration and corresponded to the maximal concentration of I^{131} in the blood. (auth)

5837 EMOTIONALITY AND AVOIDANCE CONDITIONING TO X RADIATION. Jack Arbit (Northwestern Univ., Chicago). J. Comp. Physiol. Psychol., 54: 653-7 (Dec. 1961).

To evaluate 2 variables, environmental and subject, and to obtain evidence regarding 2 alternative explanations of the conditioned-avoidance phenomenon using x radiation, tests were carried out in rats. Pre-irradiation tests revealed each animal's preference for a black box (single cue) or black box with rod floor (2 cues) as opposed to an adjoining white box (single cue) or white box with cloth floor (2 cues) by the amount of time the animal spent in

each compartment during a 2-hr period. Eight days of training followed in which on alternate days the animal was confined to an appropriate black box and irradiated (410 r over 4 days) or merely confined to an appropriate white box. Then a postirradiation measure of preference was obtained in the choice apparatus employed for the pre-irradiation determination. Emotionally reactive animals spent significantly less time in the black compartment both before and after avoidance-conditioning trials. On the basis of the difference in time spent in the black compartment before and after irradiation as a measure of change of preference, emotionally reactive animals spent significantly less time in the black side after irradiation than they had before irradiation. There were no changes in the nonreactive animals' preference before and after irradiation. Also, there were no differences noted as a function of number of cues available. The findings were interpreted on the basis of radiation producing an increment to the drive level inherent in the organism. The alternative explanation of radiation affecting preference by inducing a state of increased activity was ruled out. (H.H.D.)

5838 X-RAY STERILIZATION OF IMMATURE FEMALE RATS. Anita M. Mandl and S. Zuckerman (Univ. of Birmingham, Eng.). J. Endocrinol., 23: 179-92 (Oct, 1961).

Ovaries of female weanling rats 18 to 29 days old were irradiated with 2200, 3150, or 4400 r. Judged by the absence of germ cells, direct irradiation of ovaries with 3150 and 4400 r leads to sterilization. Sterilization was often incomplete following exposure to 2200 r, some oocytes remaining. The age at which the vagina opened was about the same in animals sterilized at the age of 21 to 29 days as in their litter-mate controls. The rupture of the vaginal closure membrane was somewhat delayed in animals exposed to 4400 r at 18 to 20 days, and in unilaterally ovariectomized animals exposed to 4400 r at 23 to 26 days. Complete atrophy of the uterus did not occur within the experimental period of 12 weeks. The degree of involution corresponded to that of the ovaries. Changes in body weight and the weight of the pituitary and thymus were similar to those observed in adult rats following x-ray sterilization. Treatment with gonadotropins immediately after x irradiation (at the age of 19 to 24 days) led to a less rapid breakdown of the vaginal closure membrane in rats exposed to 4400 r than in either similarly treated litter-mates exposed to 3150 r or their nonirradiated controls. Treatment with gonadotropins during the 5 days preceding x irradiation (at the age of 23 to 26 days) was followed by an increase in subsequent secretion of estrogen, as judged by the pattern of vaginal smears and the weight of the uterus. The results indicate that x-ray sterilization leads to a more rapid cessation of ovarian secretion when carried out before than after the normal time of puberty, and that induction of precocious puberty by treatment with exogenous gonadotropins before but not after exposure to a sterilizing dose of x rays is associated with prolongation of the secretory capacity of the ovary. Whereas the ovaries of immature rats are capable of responding to gonadotropins immediately after exposure to 3150 r, the response is severely impaired 4 days after exposure to 4400 r. The difference between the 2 groups is probably due to the fact that a few follicles survived treatment with 3150 r, at least during the first few days after irradiation, whereas exposure to 4400 r was followed by a rapid elimination of all follicles. The finding or regressing corpora lutea in many of the ovaries treated with 3150 r lends support to this view. An alternative, though less likely, hypothesis is that the damage to interstitial cells was more severe in the animals given the higher dose of x rays and treated with gonadotropins after a delay of 4 days. (H.H.D.)

5839 LOWER BODY X IRRADIATION AND 3-METHYLCHOLANTHRENE ADMINISTRATION IN BREAST-TUMOR INDUCTION IN THE WISTAR RAT. Harry Shay, Margot Gruenstein, Claire J. Shellabarger, Woodrow B. Kessler, and L. L. Ashburn (Temple Univ., Philadelphia and Brookhaven National Lab., Upton, N. Y.). J. Natl. Cancer Inst., 29: 1069-82(Dec. 1962).

X irradiation (400 r) to the caudal half of the body of Wistar rats was weakly tumorigenic and even weaker as a carcinogen. Tumors appeared almost entirely in the area of x-ray exposure. Appearance time of 1 x-ray-induced adenocarcinoma and the average for 5 fibroadenomas were long compared with mean appearance time (MAT) of first adenocarcinoma induced by 3-methylcholanthrene (3-MCA). Partial body x ray plus 3-MCA decreased MAT significantly. Partial body x irradiation and a 2 mg dose of 3-MCA 6 days a week shifted tumor frequency in favor of x-ray-exposed area. A 5 mg dose of 3-MCA alone so equalized distribution of tumors between thoracocervical (TC) and abdominoinguinal areas (AI) that added x-ray exposure of AI area produced no further significant shift. Breast-tumor induction by x radiation was almost entirely a local tissue action. However, action of x rays on 3-MCA breast-cancer induction may also have carried a systemic effect. X ray (400 r) delivered to the caudal half of the body affected ovarian weight and histology. The changes did not abolish the functional capacity of ovaries to supply promoting agents important for induction of breast cancer by 3-MCA. Increasing daily dose of 3-MCA from 2 to 5 mg hastened appearance time of all breast cancers, increased tumors per tumor-bearing animal, and tended to equalize distribution and induction time of cancers in TC and AI areas. Increasing daily dose of 3-MCA enhanced its promoting action, its high efficiency as an initiator having been demonstrated with a 2 mg dose. (auth)

5840 THE RADIATION TREATMENT OF PITUITARY ADENOMAS. José N. Correa and Isadore Lampe (Univ. of Michigan, Ann Arbor). J. Neurosurg., 19: 626-31(Aug. 1962).

From 1940 to 1959, 130 patients with pituitary adenomas were treated with external radiation. In 99 patients the diagnosis was chromophobe adenoma and in 31 eosinophilic adenoma. All patients were treated by a single course of consecutive daily sessions, the majority with x rays (200 to 250 kv range). Of these, 31 patients were treated with a dose of 2000 r (estimated tumor dose) in about 2½% to 3 weeks. Others received an estimated tumor dose of about 3000 r in about 3½ to 4 weeks. Since 1955, 49 patients were treated with Co^{60} or Cs^{137} radiation to calculated tumor doses of about 4000 r in 4 to 4½ weeks. Satisfactory results were obtained in 56.3% of patients with chromophobe adenoma and 63.3% of those with eosinophilic adenoma. Good results also were obtained in 5 of 6 patients with Cushing's syndrome treated primarily by radiation. One case of complete clinical reversal of acromegaly following irradiation is presented. Improvement in results was noted with increase in radiation dosage; 44.4% satisfactory results were noted with doses of 2000 to 2500 r, 60.6% with doses of 2900 to 3500 r, and 79.3% with doses of about 4000 r. Co^{60} and C^{137} teletherapy showed advantages, such as reduced volume of tissue irradiated and skin- and hair-sparing effects. This survey shows no significant difference in the results obtained by surgery plus irradiation

and by radiotherapy alone. However, some patients with a rapidly progressive course and, therefore a poorer prognosis, more often were treated initially with surgery. (H.H.D.)

5841 BRAIN SCANNING WITH MERCURY^{203} LABELED NEOHYDRIN. Carl A. Brinkman, Audrey V. Wegst, and Edgar A. Kahn (Univ. of Michigan Medical Center, Ann Arbor). J. Neurosurg., 19: 644-51(Aug. 1962).

Photoscanning with Hg^{203} was shown to be a useful diagnostic method for localization of intracranial tumors. It is an outpatient procedure carrying no immediate risk but the dosimetry, particularly in children, does not justify its indiscriminate use as a screening procedure. A blocking dose of a mercurial diuretic should be given intramuscularly to minimize effects of radiation to the kidneys. Every patient with a positive scan showed an expanding lesion. Scanning can be carried out by one easily trained technician at a cost comparable to percutaneous arteriography. Malignant gliomas almost invariably are localized by scanning. Meningiomas were localized in over 80% of the cases; the 2 that failed to localize were characterized by their relative avascularity. In patients with intracranial metastases, scans were positive in 70%. When there was a differential isotope uptake in tumors, abscesses, and subdural hematomas, new blood-vessel formation was demonstrated in each. (H.H.D.)

5842 THE USE OF IONIZING RADIATION AND ESTROGEN TREATMENT IN THE DETECTION OF HORMONE SYNTHESIS BY THE SERTOLI CELLS. D. Lacy and B. Lofts (St. Bartholomew's Hospital Medical Coll., London). J. Physiol. (London), 161: 23-4P(Apr. 1961).

Previous studies showed that after high doses of radiation the lipid content of the Sertoli cells becomes greatly increased. In the present experiments rats were irradiated and small fragments of their testes examined cytochemically and the remainder homogenized in a lipid solvent. Only a small amount of lipid was seen in interstitial tissue while a large amount was present in Sertoli cells. The lipid extracted from irradiated testes gave a positive response to tests for progesterone or its metabolites. The hormonal activity is attributed to the lipid of the Sertoli cells. In rats treated with estrogenic hormone, by means of both light and electron microscopy a marked increase in Sertoli cell lipid was demonstrated whereas the interstitial lipid remains at a very low level. Lipid extracted from the testes of estrogen-treated rats also gave a positive test for progesterone. The accumulation of large amounts of lipid in irradiated and estrogen-treated rats was correlated with the lack of spermatogenesis in the 1st group and its inhibition in the latter. Hence it is concluded that the Sertoli cells synthesize a steroid hormone, the Sertoli cell hormone (SCH), which is normally utilized during spermatogenesis. Estrogenic hormone causes necrosis of primary spermatocytes during meiotic prophase. When follicle-stimulating hormone (FSH) is applied the lipid content of the Sertoli cells is reduced to normal levels and spermatogenesis restored. Thus FSH is necessary either for the final stages of synthesis or secretion or both of SCH. (H.H.D.)

5843 METABOLIC CHANGES IN ERYTHROCYTES FOLLOWING GRADED DOSES OF WHOLE-BODY RADIATION. W. K. Metcalf (Univ. of Bristol, Eng.). J. Physiol. (London), 161: 27-8P(Apr. 1962).

The resistance of intracellular hemoglobin to oxidation by nitrite ions was previously shown to be affected in the rat by whole-body radiation (500 r). Rats were irradiated in the dose range 3 to 1000 r (Co^{60}) at a rate of 36 r/min. Following 1000 r, the hemoglobin oxidation stability is markedly decreased within 12 hr, but with smaller doses the effect is increasingly delayed. Very small doses, 3 r and 6 r, however, produce their effect appreciably more rapidly than do intermediate dose levels, 15 r and 30 r. The ultimate change in stability produced by radiation seems to be independent of dose (3 to 500 r). The hemoglobin oxidation stability of rats receiving 500 r remained low for at least 100 days following irradiation, but with doses of 250 r or less the animals returned to normal in this respect in from 5 to 7 weeks. The rate of return also seemed to be independent of the initial dose (3 to 250 r). The increased sensitivity of the hemoglobin of pregnant, young, or starving rats to oxidation by nitrite is partially or completely reversible by the administration of riboflavin. Riboflavin is completely without effect, however, on the increased sensitivity caused by irradiation (500 r), unless ATP is administered simultaneously. At least partial reversion to normal then occurs. Simultaneous administration of repeated doses of ATP and riboflavin to rats which had received a lethal dose of radiation (1000 r) had no effect either on hemoglobin stability or time of death. (H.H.D.)

5844 SENSITISATION OF BLOOD VESSELS TO HYPERTENSIVE DAMAGE BY X IRRADIATION. A. W. Asscher, C. Wilson, and Sally G. Anson (London Hospital). Lancet, 1: 580-3(Mar. 18, 1961).

Investigations were made to test the hypothesis that x radiation increased the susceptibility of the renal arteries to hypertensive damage. A loop of mesentery was irradiated, and, at monthly intervals thereafter, hypertension was produced by renal artery constriction. The incidence of vascular lesions in the irradiated loop was then compared with that in the remainder of the mesentery in hypertensive animals, and in control animals which were irradiated but were not submitted to renal artery clipping. Doses less than 1000 r did not produce sensitization even after an interval of 4 months. At the higher dosage levels (1000 and 1200 r), arterial lesions were observed in the mesentery 2 months after irradiation. These were seen only in hypertensive rats, and animals showing no macroscopic lesions at 2 months did not develop them later. The observations were not continued beyond 4 months since with progressive rise in blood pressure, hypertensive lesions begin to appear in nonirradiated tissues at this time. It was concluded, therefore, that 2 months after 1000- or 1200-r x irradiation, the arterial wall becomes more vulnerable to the damaging effects of increased intravascular pressure. Irradiation may weaken the vessel wall, by structural damage to the endothelium or to the muscle-fibers of the media, and such vessels may more readily undergo mechanical disruption when the intravascular pressure rises. It is also possible that irradiation of blood vessels increases their susceptibility to hypertensive damage by exaggerating their myogenic response to variations in intravascular pressure, by reducing the threshold stimulus at which normal and excessive vasoconstriction occurs. The resulting renal ischemia might then give rise to hypertension in the same way as structural narrowing of the renal arteries. The sequence of events observed after irradiation of the kidneys was consistent with the hypothesis, since the increased susceptibility of the arteries to a rise in intra-arterial pressure was observed 2 months after irradiation, the blood pressure started to rise after about 3–4 months, and arterial necroses developed when hypertension was established at a high level. (H.H.D.)

5845 DAMAGE TO CHROMOSOMES BY THERAPEUTIC DOSES OF RADIOIODINE. Elizabeth Boyd, W. Watson Buchanan, and Bernard Lennox (Western Infirmary, Glasgow). Lancet, 1: 977-8(May 6, 1961).

Investigations were made of leukocyte chromosomes in 6 thyroid patients treated with I^{131} (6 to 11 mc in 4 cases and 100 to 150 mc in 2 cases). A fall in the proportion of cells with the normal chromosome number and the appearance of chromosomes with structural abnormalities were noted in 2 cases (5 and 6) in which large doses were given. Normally the percentage of cells with the modal number is usually over 90 and rarely below 85; thus 62% in one case and 55% in another represent gross defects. The findings in 4 cases of thyrotoxicosis treated with smaller doses are equivocal. The structural chromosomal abnormalities consisted of dicentric abnormalities and fragments. These are both extremely rare in non-irradiated cultures. There was some indication that structural abnormalities appear later and persist longer than number abnormalities. It was concluded that 100 mc of radioiodine can produce changes not very different in degree from those described as following a single x-ray dose of 250 rad to the spine and that even smaller doses, of the order of 10 mc, used in the treatment of thyrotoxicosis, may produce recognizable changes. (H.H.D.)

5846 CHROMOSOMAL ABERRATION AFTER DIAGNOSTIC X IRRADIATION. John S. S. Stewart and Ann R. Sanderson (Queen's Coll., Dundee, Scotland). Lancet, 1: 978-9(May 6, 1961).

Chromosomal aberration in a leukocyte culture of the peripheral blood from a patient with medullary dysgenesis (chromatin-positive Klinefelter's syndrome) was observed shortly after exposure to diagnostic irradiation; 31 metaphase plates in the cells were analyzed. In 29, the usual chromosome number (47) and sex-chromosome constitution (XXY) were found. In 2 other plates an abnormally long and apparently dicentric chromosome was present. The aberration might have been induced by the diagnostic irradiation or by background radiation. Alternatively, it might be related to the patient's abnormal karyotype, or it could have arisen in culture. Similar aberrations were not seen in other patients, either before or after diagnostic irradiation; and there is at present no evidence to suggest either that chromosomal aberrations of this type arise other than as a rare event, or that such aberrations are harmful. (H.H.D.)

5847 EXTRACORPOREAL IRRADIATION OF THE BLOOD: A POSSIBLE THERAPEUTIC MEASURE. L. G. Lajtha, C. L. Lewis, R. Oliver, A. J. Gunning, A. A. Sharp, and Sheila Callender (United Oxford Hospitals, Oxford). Lancet, 1: 353-5(Feb. 17, 1962).

It is proposed that in some cases of leukemia, in which blast cells are present in circulating blood, extracorporeal irradiation of blood may have therapeutic benefit. By sterilizing a significant portion of these blast cells, which may return to bone marrow and proliferate, leukemic metastases may be diminished. It was calculated that in leukemia, ~1% of blast cells are exchanged per min between the marrow and peripheral blood which is equivalent to a 63% exchange of the cells in 2 hr. By means of a Co^{60} source it would be possible to sterilize all cells making one passage through a circulation unit which would draw blood from the femoral vein, for example, and return it via antecubital vein. An 8-hr irradiation of blood passing through the loop would sterilize 99% of the whole blast cell population; however, the remaining 1% of cells would be expected to cause recurrence of leukemia. Extracorporeal irradiation was attempted in 2 leukemia patients; the course of the disease was not influenced, but no untoward effects were noted. The blood was circulated in coils through a 100-c Co^{60} source which gave an average dose rate to the coils of 1000 rad/min. At a flow rate of 400 ml/min, each blood cell received 250 rad, or 7500 rad after the 6-hr circulation period. The 2 patients studies were not ideal subjects for testing the technique since they had relatively few circulating blast cells; therefore, it is suggested that further trials of extracorporeal irradiation of blood be conducted. (H.H.D.)

5848 MATERNAL RADIATION AND MONGOLISM. W. J. Schull and J. V. Neel (Univ. of Michigan Medical School, Ann Arbor). Lancet, 1: 537-8(Mar. 10, 1962).

Data are cited on the incidence of mongolism in children of mothers exposed in Hiroshima and Nagasaki which apparently contradict the report of Uchida and Curtis (ibid. 2: 848(1961)) that the risk of mongolism is increased 4 times in infants of mothers undergoing diagnostic x-ray procedures. Between 1948 and 1954 the potential genetic effects of the Hiroshima and Nagasaki atomic bombs were studied in 76,626 infants examined shortly after birth. The problem of assigning individual doses has so far proved insurmountable; however, from further data on the exposures in Hiroshima and Nagasaki, and the subclassification of the exposed it is possible to estimate very roughly a mean whole-body dose among the exposed mothers of 36 rep, with the true mean apt to lie between 26 and 45. Introducing a factor of 0.8 for the (probably maximum) attenuation of the gonad dose due to the superimposed tissues, the estimated mean gonad dose becomes 29 rep. No significant association of mongolism with maternal exposure is evident; moreover, the deviation is actually in the direction of an excess among the unexposed. The frequency of mongoloidism is 1.27 and 0.54 per 1000 among unexposed and exposed mothers, respectively. If exposure had increased by a factor of 4 the risk of mongolism, then the expected number of children with mongolism among the 5582 children of the exposed mothers in Hiroshima and Nagasaki, assuming equality of dosage with the x-ray treated mothers of Uchida and Curtis, would be 28.3. This is in contrast to the observed number of 3. (H.H.D.)

5849 RADIATION INJURIES OF CRANIAL AND CEREBRAL BONES IN A CHILD ASSOCIATED WITH ROENTGEN THERAPY FOR ADENOCARCINOMA OF PAROTID GLANDS. T. D. Mirimova and T. S. Andreeva. Med. Radiol., 7: No. 11, 36-9(Nov. 1962). (In Russian)

A severe radiation injury of soft tissues, cranial bones, and necrosis of contiguous lobes of the brain as the result of roentgen therapy in a 6-year-old girl for adenocarcinoma of the parotid gland is described. During three courses of x-ray therapy the girl received a total dose of 21,525 r. (auth)

5850 PERIPHERAL BLOOD CHANGES IN PERSONS SUBJECTED TO THE ACTION OF IONIZING RADIATION. E. V. Karibskaya and T. E. Matetskaya. Med. Radiol., 7: No. 11, 39-45(Nov. 1962). (In Russian)

Studies were made of the peripheral blood picture in ambulatory patients subjected to different modes of radium therapy for malignant neoplasms of diverse localization. The following deviations were revealed: alterations of the total content of leukocytes, a reduction of the number of lymphocytes, monocytosis, and eosinophilia. The cellular changes were manifested by course of fine dust-like toxic granulation in the protoplasm of neutrophils, fragmentation of neutrophil nuclei, karyorhexis, vacuolization of nuclei, and protoplasm of monocytes and eosinophils. Of the modes

of radium therapy the method of rotation irradiation is the most sparing in respect to the picture of the peripheral blood. (auth)

5851 EARLY CHRONAXIE CHANGES OF THE HUMAN CUTANEOUS AND VISUAL ANALYZERS FOLLOWING SINGLE LOCAL X-RAY IRRADIATION. A. S. Efimova. Med. Radiol., 7: No. 11, 45-50(Nov. 1962). (In Russian)

The detection of early functional changes of receptor apparatus of the cutaneous and visual analyzers in persons following the effect of single local high doses of ionizing radiation was studied. The method of chronaximetry was used. Twenty-four persons who had sustained the local action of x rays (600 r) on two parametric fields were examined. Thirty minutes after irradiation, a diminution of chronaxie was observed both at the site of direct irradiation and in remote places not connected by reflex influences with the organs irradiated. This intensified the role of changes in the condition of nervous system centers. However, the more marked chronaxie changes in the irradiated areas was the basis for confirming the presence of direct alterations in the receptors or surrounding tissues. (auth)

5852 CONCERNING EVALUATION OF THE FLUORESCENT-MICROSCOPIC BLOOD AND BONE MARROW PICTURE IN ROENTGEN IRRADIATION. V. A. Kolpakov. Med. Radiol., 7: No. 11, 50-3(Nov. 1962). (In Russian)

Studies on the luminiscent blood and bone marrow picture in irradiated rats showed that the fluorochrome coating of the elements, made by means of acridine orange, was more effective with the pH in the primitive humid chamber equalling 7 or 8. The changed luminiscent coloring of the cellular elements, stained with acridine orange, cannot be considered to be a reliable criterion in assessing the severity of the radiation injury they have been subjected to. An adequate appreciation of the degree of the injury sustained by the blood and bone marrow cells must be of a complex nature, with due account of structural changes in the cellular elements. Considering that many environmental factors may produce a luminiscent picture similar to that consequent to the effect of roentgen irradiation and in view of the method being highly sensitive to even slight changes in experimental conditions, to obtain authentic and uniform results, a thorough standardization of the latter is imperative. (auth)

5853 FEATURES PECULIAR TO THE MECHANISM OF LEUKOPENIA IN ACUTE RADIATION SHOCK. V. M. Voityuk. Med. Radiol., 7: No. 11, 82-3(Nov. 1962). (In Russian)

Experiments were carried out on 16 rabbits exposed to 1000, 1500, and 2000 r in order to determine the mechanism of leukopenia during acute radiation injuries. Simultaneous drops in hemoglobin, erythrocytes, and leukocytes were observed in all animals. The maximum drop in hemoglobin after exposure to 1000 r was about 3%, and 5% after 1500 and 2000 r exposures. The drop in erythrocytes in animals exposed to 1000 r was 2% and 11.8 and 13.1% at 1500 and 2000 r. A different picture was observed in the leukocyte reactions. After 2 to 3 hour exposure to 1000 r the leukocyte number dropped 69.9%. The number of leukocytes increased on the 3rd to 5th day, however, it never reached the initial level. Following a 2-hr exposure to 1500 r the number of leukocytes dropped 79.9%; rehabilitation began 5 hr later. The data indicate that smaller doses permit faster specific weight redistribution in leukopenic development, while with larger doses leukocytic redistribution is quickly replaced by heavy organic changes in the blood and marrow. (R.V.J.)

5854 EFFECT OF BONE-MARROW ON REGENERATION OF LIVER OF X-IRRADIATED RATS. E. Czezel, G. Vaczó, and P. Kertai (State Inst. of Public Health, Budapest). Nature, 196: 240-1(Oct. 20, 1962).

The effect of bone marrow extracts on liver regeneration in normal and x-irradiated rats was examined. Results show that treatment with bone marrow extracts decreases the number of deaths caused by irradiation. Under the effect of x radiation the loss of weight in the hepatic regenerate remained significant even when the liver was protected during irradiation of the whole body. When the liver was exposed to radiation and the bone marrow was protected, the weight of the liver regenerate was greater than the weight of liver regenerate exposed during irradiation of the whole body. Regeneration of liver continued with maximum intensity after the injection of bone marrow suspensions. Bone marrow extract exposed to irradiation in vitro was ineffective. Possible mechanisms involved in the ineffectiveness of x-irradiated bone marrow are discussed. (C.H.)

5855 DENATURATION OF DEOXYRIBONUCLEIC ACID OF ESCHERICHIA COLI BY X-IRRADIATION IN VITRO. Madhuri Sarkar (Saha Inst. of Nuclear Physics, Calcutta). Nature, 196: 269-70(Oct. 20, 1962).

Desoxyribonucleic acid (DNA) extracted from Escherichia coli was examined for the effects of x radiation on the ultraviolet absorption spectrum. Typical ultraviolet absorption curves obtained from nonirradiated, irradiated, and acid-denatured DNA solutions are presented. A comparison of the curves shows that the denaturation factor increased rapidly with dose, to about 54% of the maximum possible denaturation observed in the acid denatured control. It is concluded that there is a progressive increase in the disruption of hydrogen bonds as determined from the increase in the extinction coefficient with increasing radiation dose. (C.H.)

5856 EFFECT OF EXPOSURE TO IONIZING RADIATION ON CREATINE CONCENTRATION IN HUMAN AND RAT ERYTHROCYTES. S. S. Kurohara and K. I. Altman (Univ. of Rochester, N. Y. and Strong Memorial Hospital, Rochester, N. Y.). Nature, 196: 285-6(Oct. 20, 1962).

Results are reported for serial determinations of creatine concentration in the erythrocytes of cancer patients undergoing radiotherapy, and in erythrocytes, plasma, and urine of sham-irradiated rats and in rats exposed to doses of 500, 1000, or 1500 r x radiation. The concentration of creatine in erythrocytes of the patients rose after 2 to 3 weeks of radiotherapy. The erythrocytic creatine concentrations rose only in the sham-irradiated rats and in rats exposed to 500 and 1000 r, whereas in rats exposed to 1500 r a marked fall in erythrocytic concentration of creatine occurred. The response observed in sham-irradiated rats was attributed to restraint during sham-irradiation. (C.H.)

5857 IMMEDIATE DETECTION OF X-RAYS BY THE RAT. J. Garcia, N. A. Buchwald, B. H. Feder, and R. A. Koelling (Long Beach Veterans Administration Hospital, Calif.). Nature, 196: 1014-15(Dec. 8, 1962).

An investigation was made of the ability of rats to perceive radiation and an attempt was made to determine the physiological receptor mechanism involved. X rays were used as a warning stimulus to signal the occurrence of a subsequent electric shock to the paws of normal and blind mice while pressing a lever to obtain food. X radiation caused an immediate arrest in the animal's lever pressing behavior. Results indicate that doses as low as 0.05 r/sec

were detected by all animals. It was concluded that phosphenes or other visual effects do not account for the response to x radiation. (C.H.)

5858 STUDIES ON THE RADIOPROTECTIVE EFFICACY OF CYSTEAMINE AGAINST 500 r FROM THE MEASUREMENT OF HEPATIC CELL PROTEIN. R. Chatterjee, P. De, and A. Bose (Chitteranjan National Cancer Research Center, Calcutta). Naturwissenschaften, 49: 421-2(1962). (In English)

The protein dry mass was measured in the different organelles of hepatic cells to evaluate the protective efficacy of cysteamine against 500 r whole-body irradiation on the fourth day after the irradiation. The experimental technique is described. The results were tabulated and showed that the highest dry mass of protein was found in the cytoplasm, heterochromatin, and nucleoli of cysteamine-protected hepatic cells. (J.S.R.)

5859 THE QUESTION OF THE THERAPEUTIC EFFECT OF CHEMICAL MATERIALS IN THE X IRRADIATION OF HIGHER ORGANISMS. H. Langendorff and I. Kunich (Universität, Freiburg i. B.). Naturwissenschaften, 49: 424(1962). (In German)

Male mice were whole-body irradiated with x-ray doses of 590, 650, and 750 r at a dose output at 150 r/min. One hour after the end of the irradiation 1 ml of olive oil was applied. The 30-day survival rate was established and it was seen there was a significant variation between the mice irradiated with 650 r and the irradiated untreated control. The application of olive oil increases the survival rate from 27 to 50%. At 750 r no therapeutic effect was established, and at 590 r the effect was very low. (J.S.R.)

5860 DEPENDENCE OF THE TUMOR DEVELOPMENT IN RATS AFTER INTRAVENOUS INJECTION OF YOSHIDA-ASCITES SARCOMA ON PRELIMINARY WHOLE-BODY X IRRADIATION. D. Schmaehl and E. Stutz (Universität, Bonn and Universitätsklinik, Freiburg i. B.). Naturwissenschaften, 49: 424-5(1962). (In German)

Wistar rats were exposed to whole-body x irradiation doses from 10 to 640 r, and 24 hrs. later were injected with Yoshida-Ascites sarcoma. The results are tabulated and show that whole body irradiation up to 80 r affects the tumor development only slightly, but higher doses increase the initiation rate. It was also shown that irradiation doses of more than 160 r significantly increase the number of liver tumors. (J.S.R.)

5861 UNUSUALLY HIGH MUTATION RATE IN BARLEY AFTER APPLICATION OF ETHYLMETHANE SULFONATE AND X-RAYS. Horst Gaul (Max-Planck-Institut für Zuchtungsforschung, Cologne). Naturwissenschaften, 49: 431(1962). (In German)

The effects of x irradiation and ethylmethane sulfonate on barley seed were compared. The radiation dose and the sulfonate concentration were so selected that they led in pairs to similar death rates of the M_1 plants. This made possible a direct comparison of the mutation frequencies induced by x radiation and ethylmethane sulfonate. The results showed that the plant of the individual dose-concentration pairs have not only comparable lethal values, but also similar effects on new shoot formation. The sterility and mutation rate for the sulfonate was much greater than for the x radiation. The sulfonate has a significantly less toxic effect than x radiation in comparable genetic effect. The lethal effect increases up to 99%. (J.S.R.)

5862 EFFECTS OF X-RAY RADIATION IN HEMIC CELLS. G. Astaldi. Nucl. Energy, IX-XI(Dec. 1962).

Investigations on structural and biologic effects exerted by x radiation on blood-forming cells surviving in vitro are reported. It was concluded that x radiation directly applied to hemic cells in vitro does not interfere only with their proliferative activity, but also with other of their biological and structural properties, such as respiration, osmotic fragility, and glycogen and enzyme contents. (P.C.H.)

5863 THE LETHAL DOSE FOR MUS MUSCULUS EXPOSED TO THE γ BEAM OF THE FRASCATI SYNCHROTRON. T. Alescio (Comitato Nazionale Energia Nucleare, Frascati, Italy), C. Biagini, E. Borghese, and M. Ladu. Nuntius Radiol., 28: 371-83(May 1962). (RT/BIO(62)70). (In Italian)

Preliminary results are reported from experiments carried out on mice in order to study lethal effects of the 1000 Mev-radiation beam produced by the electron synchroton of the Laboratori Nazionali di Frascati. Mice were placed in a special container, along the axis of the radiation beam, in a file of five subjects one behind the other. The effects of the radiation on the whole body were analyzed against total dose and against time elapsed from exposure; the position of the single animals in the container was also taken into account. Dosimetry was discussed and a method of evaluation of the dose was proposed. An average value of 1000 r resulted for LD_{∞}. Results are affected by the position of the mice in the container, owing to the spatial distribution of the dose. (auth)

5864 PROGNOSTIC SIGNIFICANCE OF CYTOLOGIC RESPONSE IN RADIATION OF GYNECOLOGIC CANCER. Stanley R. M. Zerne and John McLean Morris (Yale Univ. School of Medicine, New Haven, Conn.). Obstet. Gynecol., 19: 145-55(Feb. 1962).

In 405 patients irradiated for gynecologic carcinoma the radiation response (RR) was evaluated by changes in vaginal cells and these results were compared with survival rate. Radiation response appeared to have definite prognostic implications in Stages I and II. In the good RR group the local recurrence rate was 6% as compared with 30% in the poor RR group. This significance decreases with more extensive disease. Correlation of RR with survival was lower than in other reports. Including all stages and recurrent cases, the 3- to 8-yr survival rate in 52 patients with a poor response was 52% as compared with 58% in 120 patients with a good response. The highest RR was correlated with prognosis in 76 patients with carcinomas of the endometrium, ovary, and vagina. In 49 cases with endometrial carcinoma, 29 had a good response. Of these, 62% had no residual tumor following radiation as compared with 45% in 20 patients with a poor response. The practical value of cytologic response studies as an indication for operation was also studied. Of 24 patients with poor RR levels undergoing Wertheim procedures following radiation, viable tumor was found in operative specimens in 13 cases. Of these, 2 are living and well. Using the clinical response as the criterion for radical surgery, 29 patients were operated on. Viable tumor was found in 20 patients, 4 of whom are living and well. All patients with poor cytologic response who had residual viable tumor had also a poor clinical response. (H.H.D.)

5865 IN VITRO DETECTION OF CHARACTERISTIC DIFFERENCES IN RADIATION SENSITIVITY OF FEMALE GENITAL CANCERS. Peter P. Ludovici and Norman F. Miller (Univ. of Michigan Medical School, Ann Arbor). Obstet. Gynecol., 19: 251-6(Feb. 1962).

By a standardized assay technic in which cell monolayers were irradiated at different dose levels (100 to 1200 r) on the 4th culture day and cell counts carried out 4 days later, the radiation sensitivities of 37 cell strains,

derived from female patients with various genital cancers and from normal individuals, were assessed. These 37 cell strains had certain patterns of radiation sensitivity which, in general, appear to be consistent with the generally accepted radiosensitivity of the tumors from which the cell strains arose. Cell strains from squamous-cell carcinomas of the cervix as a group were at least twice as sensitive as those from other squamous-cell carcinomas of the female genital tract. Cell strains derived from carcinomas of the ovary, vagina, and vulva were almost equally resistant to radiation. As expected, cell strains derived from benign tissues were the most highly resistant to radiation, normal fibroblastic strains being more resistant than normal epithelial strains. (H.H.D.)

5866 SARCOMA COMPLICATING FIBROUS DYSPLASIA. PROBABLE ROLE OF RADIATION THERAPY. Howard C. Tanner, Jr., David C. Dahlin, and Donald S. Childs, Jr. (Mayo Clinic, Rochester, Minn.). Oral Surg., Oral Med., Oral Pathol., 14: 837-46(July 1961).

Four cases in which sarcoma complicated fibrous dysplasia were encountered at the Mayo Clinic between 1930 and 1956. In all 4 instances, facial bones were involved but there was no evidence of fibrous dysplasia elsewhere in the skeleton. The osseous lesions had been irradiated in all cases. A 5th case of postirradiation sarcoma of the jaws was observed, but histologic proof of the earlier benign process was lacking. The intervals of time between irradiation and diagnosis of sarcoma were 3, 7, 11, and 25 yr in the 4 cases. A review of all the cases of fibrous dysplasia and all the cases of sarcoma recorded in the files of the Mayo Clinic showed no examples of concomitant sarcoma and fibrous dysplasia that had not been irradiated. Therefore, while proof that sarcoma in fibrous dysplasia is always radioinduced was lacking, there was no evidence that the dysplastic process may become malignant in any other way. Also, a detailed study of Mayo Clinic cases disclosed no examples of sarcoma complicating fibrous dysplasia in bones other than the jaws. There are hazards of drawing valid conclusions concerning the relation of sarcoma and fibrous dysplasia, but evidence strongly suggests that irradiation may be an inciting factor in the development of sarcoma in these cases. Radiotherapy is ineffectual in the treatment of fibrous dysplasia, and the potential hazard of such treatment makes its use in patients with this condition unwise. (H.H.D.)

5867 A COMPARISON OF THE EFFECTS OF 200 kv RADIATION AND COBALT-60 RADIATION ON THE JAWS AND DENTAL STRUCTURE OF THE WHITE RAT. A PRELIMINARY REPORT. Irving Meyer, Gerald Shklar, and John Turner (Tufts Univ., Boston). Oral Surg., Oral Med., Oral Pathol., 15: 1098-1108(Sept. 1962).

The effects of Co^{60} and 200-kv radiation on the jaws and dental structures of rats at doses of 1020 to 2040 r were compared. Co^{60} radiation was much less damaging to bone and dental tissues than 200-kv radiation in comparable dosages. This confirmed clinical impressions concerning the bone-sparing attributes of Co^{60} radiation. Considerably higher dosages can be given with Co^{60} than with 200-kv radiation. All animals exposed to 200-kv radiation showed alterations in alveolar bone, more severe reactions occurring in animals given 2040 r. There was a decreased density and irregularity in the staining of the periodontal membrane, so that the outlines of the interdental septum of alveolar bone were sharp and clearly demarcated. The number of fibroblasts was reduced in the periodontal membrane, and the cells were smaller, rounded, and more deeply stained. Cementoblasts along the tooth surface were fewer and bone itself presented a granularity in staining and pyknosis in osteocytes. The results suggest that a 10% greater dose in megavoltage rads is necessary for an equivalent biologic effect. (H.H.D.)

5868 THE PROBLEMS OF HUMAN SURVIVAL IN OUTER SPACE. R. Margaria (Università, Milan). Panminerva Med., 3: 447-60(Oct. 1961).

A review is given, including the problems presented by ionizing radiation. (H.H.D.)

5869 CONSIDERATIONS ON THE RADIOSENSITIVITY OF CERVICAL UTERINE CANCERS. I. STUDY OF THE CRITERIA OF RADIOSENSITIVITY OF CERVICAL UTERINE CANCERS. L. Darcis (Université, Liège). Pathol. Biol. Semaine Hop., 10: 1291-5(Sept. 1962).

Radiosensitivity of tumors is considered from the point of view of the tumor itself and of the host tissue. Characteristics of tumors are discussed in relation to their macroscopic and histologic appearance, cytology as seen in vaginal smears, histo- and cytochemistry, uptake of radioisotopes, and possibilities of culture in vitro. Macroscopically, exophytic tumors are considered more amenable to radiotherapy than endophytic types. They tend to be discovered earlier, are less invasive, and their better vascularization makes them more radiosensitive. The early response of exophytic tumors to irradiation has long-term prognostic significance. With 272 irradiated exophytic cervical carcinomas the 5-yr survival rate was 71% after an initial favorable reaction compared with only 23% after a poor initial radioresponse. Histologically, there is some evidence that the more differentiated tumors are more radioresponsive. Biopsy of irradiated tumors may indicate their radiosensitivity, e.g., the presence of cells in telophase and normal anaphase may be interpreted as a sign of radioresistance. Rapid disappearance of cancer cells in vaginal smears after irradiation is of favorable prognostic significance. The failure of irradiated tumor cells to show a fall in deoxyribonucleic acid content indicates radioresistance; this may also be interpreted from the rate of P^{32} uptake of the cells before and after irradiation. Reactions of normal host cells to irradiation are also of prognostic value. Marked cytologic changes in normal cells and appearance of inflammatory cells in vaginal smears indicate a good response, whereas cornification reflects radioresistance. However, no single factor, but a combination of factors, must be considered in assessing the radiosensitivity of cervical carcinomas. (H.H.D.)

5870 CONSIDERATIONS ON THE RADIOSENSITIVITY OF CERVICAL UTERINE CANCERS. II. POSSIBILITIES OF AUGMENTING THE RADIOSENSITIVITY OF CERVICAL UTERINE CANCERS. L. Darcis (Université, Liège). Pathol. Biol. Semaine Hop., 10: 1297-1300(Sept. 1962).

Various means of increasing the sensitivity of tumors to radiation are considered, including oxygenation, hormones, chemical sensitizers, temperature changes, and other ways of altering metabolic activity. Techniques for increasing the oxygen supply of tumors during radiotherapy and the difficulties encountered are discussed. Radiosensitivity of some tumors can be enhanced by treatments with sex and adrenal steroids, gonadotropins, and thyroid hormones; however, pregnancy in rats was found to increase radioresistance of vaginal mucosa. It was also shown that, in the rat, injury to the rectum can be prevented during pelvic irradiation by local application of cystamine, without diminishing radiosensitivity of the vagina. (H.H.D.)

5871 ADVANCES IN RADIOTHERAPY. I. Churchill-Davidson (St. Thomas's Hospital, London). Practitioner, 189: 520-6(Oct. 1962).

Recent developments in radiobiological research are discussed in relation to their application to radiotherapy of malignant tumors. It is becoming increasingly apparent that all mammalian cell lines have approximately the same inherent radiosensitivity when maintained under similar conditions of cell reproduction. The rate of cell turnover only determines the time that will be taken before the damage shows itself. Radiotherapy of malignant tumors is feasible only because of the slow rate of cell division in normal vital structures, the fact that sublethal radiation injury can be quickly repaired, and the likelihood that histiocytes, fibroblasts, and capillary endothelium can migrate into the irradiated area from outside to repair the damage. The finding that tissue anoxia enhances radiosensitivity can be applied by giving the patient oxygen to breathe, or making the tumor area anoxic and giving 3 times the normal dose. It has now been shown conclusively that a dose of x rays is much more effective in killing cells if given in a single dose or in a small number of large fractions, than if split into a large number of small daily doses, as has been the past practice in clinical radiotherapy. It is estimated that 100,000 people have now been treated with radioiodine for thyrotoxicosis. Sufficient time has now elapsed to show that no significant increase in either thyroid carcinoma or leukemia has occurred. (H.H.D.)

5872 LONG-TERM EFFECT OF INTERNAL IRRADIATION BY I^{131} ON THE HAEMATOPOIETIC ORGANS AND HYPOPHYSIS. H. Takemoto (Hiroshima Univ.). Proc. Inst. Nucl. Paediat. Res. (Japan), 1: 71(1960).

Long-term observation was performed on mice of strain dd N after the administration of 1 μC/g and 5 μC/g of I^{131} by means of hematological study, histological examination, and radioactivity measurement. With 1 μC/g of I^{131} less destruction and complete regeneration of the thyroid was found. However, the loss of radioactivity due to destruction of tissues taking it up was relatively slight, and, therefore, the amount of radioactivity acting on the blood-forming organs was presumed to be relatively strong. On the other hand, in the administration of 5 μC/g, there was relatively much less radioactivity in the thyroid due to destruction. Therefore, less influence was exerted on the hematopoietic tissue. In the hypophysis there was a progressive change in the anterior lobe, which may lead to tumor formation. (Abstr. Japan Med., 2: No. 9, Sept. 1962.)

5873 MODERN RADIOBIOLOGY AND THE RADIOTHERAPIST. Frank Ellis. Proc. Roy. Soc. Med., 54: 1133-42(Dec. 1961).

Optimal conditions for the destruction of cancer cells by radiation are considered. Recent cell-survival experiments underline the need for accurate knowledge of dose given, the need for as high a dose as is compatible with normal tissue tolerance, and the desirability of making the dose higher still where there is no normal tissue present as in the middle of a necrotic gland or where severe damage to normal tissue can be tolerated. The necessity for rational, close, and continual cooperation between surgeon and radiotherapist becomes more essential both in treating malignant disease and repairing radiation damage. Treatment by fractionated methods requires revision. The most important determinant for rational fractionation is the duration of the cell cycle, especially during a course of irradiation, both for normal cells and malignant cells, in individual cases. Dosage inaccuracies in radiotherapy due to poor planning and lack of correction for tissue heterogeneity are more important than hitherto considered in relation to the number of cells spared by a 10% or 20% diminution in dose. Similarly, treating all the fields for a given volume at every treatment seems to be of greater importance than has hitherto seemed likely. Management of cancer patients must be modified to fit these new facts. (H.H.D.)

5874 TOTAL BODY IRRADIATION FOR ORGAN TRANSPLANTATION. M. Tubiana, C. M. Lalanne, and J. Surmont. Proc. Roy. Soc. Med., 54: 1143-50(Dec. 1961).

The effects of high-dosage Co^{60} irradiation in 11 patients undergoing kidney transplantation are described. Uniform whole-body exposure to doses of 400 to 450 rads (administered over 7 to 8 hr) appears to be well tolerated, provided that certain precautions are observed. With such doses, hemorrhages are of a relatively minor nature and easy to control. The risk of infection is much more serious; it would appear that this danger can be averted by observing strict aseptic precautions and that it is possible for a patient to live for a month or more in an atmosphere much more sterile than that of an operating theater. Under these conditions and by the use of antibiotics, not as a routine measure, but for specific therapy, it appears possible to reduce the risks of infection. The immediate effects of irradiation are relatively mild. During the actual exposure, when the dose reaches 150 to 200 rads the patient experiences a sensation of asthenia, with a tendency to nausea, and exhibits tachycardia, pallor, and anxiety. During the first few days after irradiation the symptoms were very slight. Loss of hair started on the 16th day and was complete on the 20th. None of the patients exhibited convulsions or neurological disturbances. The number of circulating reticulocytes fell immediately after irradiation, and from the 15th day was less than 5%. The count began to rise again at the same time as the white blood count increased. The number of lymphocytes fell rapidly 3 to 5 days after irradiation. The minimum was about 4% of the initial value, a figure similar to that observed in the rat after a dose of 400 r. In 4 of 5 patients, there was a slight rise in the lymphocyte count beginning on the 8th day and subsequently a fall. The number of lymphocytes then remained very low, until about the 22nd to 25th day. Granulocytes began to fall almost immediately after irradiation; the fall was precipitate at first, but became slower after the 5th day. The granulocyte count then remained constant or even showed a slight rise. From the 15th day the number began to fall again, reaching a minimum on the 18th day. During this phase of almost total agranulocytosis, the white cell count was below 500, sometimes below 200. The phase lasted about 7 days, with an increase again between the 22nd and 26th day. The platelet count reached a minimum between the 15th and 20th day. The hematological findings during the first 2 weeks after irradiation in a patient who received 600 rad were very similar to those of patients who received 400 rad. A 2nd irradiation 2 months later in several patients caused reactions of unexpected severity considering the dose (100 rad) and previous results in animals. Marked, persistent bone marrow aplasia occurred in both patients, and in one, led to fatal septicemia unresponsive to antibiotics. (H.H.D.)

5875 THE PRIMARY MECHANISM OF THE GENETIC EFFECT OF RADIATION. B. N. Sidorov (Inst. of Biological Physics, Moscow). Radiobiologiya, 2: 641-6(1962). (In Russian)

The specific chemical changes taking place in chromosomes under the direct and indirect effects of radiation are briefly reviewed. It has not been possible to separate the direct effects from the indirect effects of radiation. For example, it is not known how radiosensitivity and the formation of mutations are related to the nucleotide composition

of DNA in chromosomes, or to the structure and composition of the protein component in chromosomes. The chemical changes occurring also depend on the composition of the surrounding medium, and on conditions during and after irradiation, as can be seen from the oxygen effect, and the effect of protective agents on dry polymers. The indirect effects are due to the formation of free radicals in the radiolysis of water, and many protective agents are useful in suppressing the deleterious effects caused by free radical formation. The idea of a primary break in the DNA chain has been a fruitful hypothesis in explaining many of the facts of genetic theory. However, this simple idea will have to undergo considerable modification in order to include facts on chemical exchange, especially on protein exchange, which are being uncovered. 28 references. (TTT).

5876 THE KINETICS OF THE RADIATION DAMAGE OF CELL POPULATIONS. A. D. Strzhizhovskii. Radiobiologiya, 2: 647-53(1962). (In Russian)

Undifferentiated cells possess mitotic activity, and are readily damaged by irradiation during mitosis. If it is assumed that the physiological damage to a cell as expressed by a reduction in mitotic activity during irradiation can be separated from the genetic damage to the cell (which is irreversible), the following differential equations can be written for the balance of undifferentiated cells at any time t: $dp(t)/dt = (k_p - w_p)\, p(t)$ and $dg(t)/dt = (k_g - w_g)\, g(t)$. Here p(t) represents the cells of a group of undifferentiated, irradiated cells that have avoided genetic damage, and g(t) represents the cells that have been genetically damaged. In addition, k_p and k_g are the probabilities of division, and w_p and w_g are the probabilities for the elimination of cells from the tissue per unit of time for the p and g groups respectively. Equations are derived for the index of normal mitotic activity I(t), and for the index of pathological mitotic activity $I_g(t)$. Since these indices can be measured experimentally, it is possible to determine the time of duration of a normal and pathological mitosis, and also the degree of damage to the nuclear and cytoplasmic structures. The relative radiosensitivities of genetic structures in mitosis and interkinesis can be determined by comparing experimental values of $I(0)/I_0$ and $p(0)/p_0$. The value of $k_p(t)$, the probability of division of time t, can also be obtained in principle. The effect of radiation on the population of differentiated cells is also considered. Changes in the age spectrum of the differentiated cell population and the change in total number of cells are taken into account. (TTT).

5877 THE RADIOLYSIS OF OROTIC ACID (URACIL-4-CARBOXYLIC ACID). M. I. Shal'nov. Radiobiologiya, 2: 654-61(1962). (In Russian)

The disappearance of pyrimidines on irradiation of polynucleotides has been observed, and thus, the radiation chemistry of orotic acid, the predecessor of pyrimidines in DNA and RNA, was investigated. The residual content of irradiated uracil-4-COOH solutions was determined from the optical density at $\lambda = 280$ mμ. The G yield for the destruction of uracil-4-COOH at concentrations of 10^{-5} to 10^{-3} M increased with increasing concentration from 1.5 to 3.0 molecules/100 ev at a pH of 7.0, and from 3.0 to 7.0 moles/100 ev at a pH of 5.5. In the presence of an equimolar concentration of persulfate, which plays the role of an activating agent, the G yield for the disappearance of uracil-4-COOH from a 3×10^{-5} M solution attains a maximum value of 11.5 molecules/100 ev at a pH of 7.0. The kinetics of the dark reaction of uracil-4-COOH with persulfate was evaluated, and it was found that the rate constant is directly dependent on the amount of persulfate present: $K = 0.1\ [\text{persulfate}]/[\text{uracil-4-COOH}]\ \text{hr}^{-1}$. This rate constant was also proportional to the square root of the hydrogen ion concentration: $K \sim \sqrt{[H^+]}$. It is pointed out that uracil-4-COOH, in general, does not give any protection against radiation when introduced before the irradiation, but is more effective when introduced after irradiation. It is felt that the formation of an intermediate peroxide of uracil-4-COOH during radiation would result in a greater mutagenic effect. (TTT).

5878 THE OXYGEN EFFECT DURING GAMMA IRRADIATION OF E. COLI CULTURES. V. I. Plokhoi (Inst. of Biological Physics, Moscow). Radiobiologiya, 2: 667-73 (1962). (In Russian)

An increase in radiation damage on introduction of oxygen after the irradiation has been observed in a number of cases. This post oxygen effect was investigated on E. coli which can be grown in vacuum and in air. Suspensions of E. coli were carefully evacuated with shaking over a period of one hour to eliminate dissolved air. The initial concentration of cells, the irradiation dose, and temperature of incubation have an effect on the growth rate of E. coli. With a 15% difference in the initial bacterial concentration, a 9% difference in growth rate was observed for a 20 hr incubation of 22.5°C. At a dose of 5000 r in vacuum or 1100 r in air, the difference in growth rate was 10%. At 20 kr in vacuum, the difference in growth rate was 33%. The results of the experiments do not show any post oxygen effect. With a dose of 20 kr in vacuum, the survival was 67 to 70% with or without the addition of oxygen after the irradiation. The survival was 37% in both cases at a dose of 50 kr. The oxygen coefficient m (or the coefficient of the oxygen effect) is defined as the ratio of the radiation dose in vacuum or nitrogen to the radiation dose in oxygen for the same radiobiological effect. The value of m is ordinarily about 3. In these experiments the value of m was 4.5. This value remained constant over a wide variety of experimental conditions. This high value of the oxygen coefficient is due to the complete removal of dissolved oxygen by shaking under vacuum. (TTT).

5879 THE EFFECT OF IRRADIATION ON NUCLEOTIDE METABOLISM IN RABBIT LIVER. I. A. Tseveleva. Radiobiologiya, 2: 674-80(1962). (In Russian)

A group of rabbits was given a whole-body dose of 1000 r from a Co^{60} source. Tests were carried out on the rabbits 30 minutes, 4, 12, 24, and 48 hours after irradiation. The control rabbits and irradiated rabbits were given an intravenous dose of 0.1 μC/g body weight of $Na_2HP^{32}O_4$, and were killed 15 minutes after being given the tracer. The nucleotide fraction was rapidly isolated from 50 g of liver tissue in the form of a barium salt. The nucleotides were separated by anion exchange on a Dowex 2 column in the formate form. The successive eluants used were H_2O, 4N HCOOH and a mixture of 4N HCOOH and 0.8N $HCOONH_4$. Paper chromatography was used to resolve the peaks further. The concentration of separate mononucleotides was calculated from absorption measurements. The results are given in micromoles per gram of dry liver. The P^{32} content is expressed in counts per minute per micromole of nucleotide as related to the counts per minute per micromole of inorganic phosphate in the acid-soluble fraction of the tissue. The following substances were identified: adenosine triphosphate (ATP), adenosine diphosphate (ADP), adenosine-5-phosphoric acid (AMP-5), ionosine-5-phosphoric acid (IMP-5), guanosine triphosphate (GTP), guanosine diphosphate (GDP), guanosine-5-phosphoric acid (GMP-5), uridine diphosphate (UDP), uridine-5-phosphoric acid (UMP-5), uridine diphosphate glucose (UDPG), uridine diphosphate

acetyl glucosoamine (UDPAGA), uridine phosphate glucuronic acid (UPGA), cytidine-5-phosphoric acid (CMP-5), diphosphopyridine nucleotide (DPN), and triphosphopyridine nucleotide (TPN). Changes in the content of separate nucleotides were noted 30 minutes after irradiation. Thus, the content of IMP-5 and of CMP-5 increased by a factor of two as compared to the unirradiated controls. The concentration of monophosphate nucleosides was higher 24 hours after irradiation: GMP-5 by 40%, CMP-5 by 38% and UMP-5 by 26% higher than normal. On the other hand, the concentration of triphosphate nucleosides was lower: ATP by 65% and GTP by 25% lower than normal. The nucleotide concentrations returned to normal levels two days after the irradiation. The rate of P^{32} incorporation by diphosphate and triphosphate nucleosides increased by 30 to 50 percent 24 hours after irradiation. (TTT).

5880 THE FORMATION AND ROLE OF QUINONES IN THE INITIAL STAGES OF RADIATION DAMAGE TO ANIMAL TISSUE. A. M. Kuzin and V. A. Kopylov (Inst. of Biological Physics, Moscow). Radiobiologiya, 2: 681-4 (1962). (In Russian)

White rats 130 to 150 g in weight were given an x ray dose of 1000 r. The rats were killed at different times after the irradiation, and quinoid compounds were isolated by extracting a 2 to 4 g sample of liver with 50% ethyl alcohol. The presence of an absorption maximum at 255 mμ showed an increased content of quinones in the irradiated tissue as compared to normal tissue. The quinone content was estimated quantitatively by adding 1 ml of aniline reagent, containing 10 ml of glacial acetic acid and 1 ml of freshly prepared aniline, to 0.5 ml of the alcohol extract along with 1.5 ml of additional 50% alcohol. It was found that the quinone content increased, and the content of dioxyphenols decreased in the irradiated tissue. No noticeable difference in oxygen absorption in a Warburg apparatus was observed on tests of homogenized liver tissue immediately after irradiation. However, if 1.6×10^{-5} M of a diphosphonucleotide is added to the irradiated liver tissue, the absorption of oxygen is almost doubled as compared to the unirradiated liver tissue. Thus, the increase in quinone content, and the diphosphonucleotide effect detected in irradiated tissue offer a logical explanation for the suppression of oxidative phosphorylation in tissues of irradiated animals. (TTT).

5881 THE INFLUENCE OF IONIZING RADIATION ON NITROGEN METABOLISM IN YEAST CELLS. R. D. Gal'tsova and A. T. Novichkova (Inst. of Microbiology, Moscow). Radiobiologiya, 2: 690-4(1962). (In Russian)

Pure cultures of Sacch. cerevisiae, Sacch. carlsbergensis, Frohberg and Sacch. carlsbergensis 10D were given an x ray dose of zero to 200 kr, and nitrogen analyses were determined on growing cultures after 48 hours. The increase in total nitrogen was 10 to 20% as compared to the controls at an irradiation dose of 20 to 30 kr. At low radiation doses of 20 to 30 kr, radiation has a stimulating effect, and the content of total protein and amino nitrogen increases. At higher doses of 200 kr, the contents of total and protein nitrogen decrease significantly, but the amount of amino nitrogen rises sharply. The contents of asparagine and alanine increase by about a factor of two, and the content of glutamic acid by 50 to 75%. The higher the irradiation dose, the higher is the content of free amino acids in the cell. A culture of Sacch. cerevisiae had a higher content of total and protein nitrogen than did cultures of Sacch. carlsbergensis. (TTT)

5882 THE EFFECT OF WHOLE-BODY, X-RAY IRRADIATION ON THE RATE OF LIPID TURNOVER IN THE BRAIN OF THE RAT. M. F. Vinogradov (Zhdanov State Univ., Leningrad). Radiobiologiya, 2: 695-9(1962). (In Russian)

White rats 100 to 150 g in weight were given x ray doses of 400, 800, and 1200 r. The rats were killed at various intervals after the irradiation that varied from 6 hrs to 20 days. In order to determine the total lipid turnover in the brain, 200 μC of C^{14} per 100 g body weight was administered subcutaneously as radioactive sodium acetate tagged at the methyl group. The radioactivity of the total lipid fraction was determined on a mica end-window counter having a window thickness of 1.6 mg/cm^2. The specific activity of the lipid fraction was also determined. The maximum lipid turnover was observed 6 hours after the irradiation with a dose of 400 r, and 24 hours after the irradiation with a dose of 800 r. A slight increase in lipid turnover was noted 72 hours after irradiated with a dose of 1200 r. The increase in lipid turnover can be considered as a manifestation of the body reactions to the effects of radiation. (TTT).

5883 THE EFFECT OF THYROXINE ON ERYTHROPOIESIS IN IRRADIATED ANIMALS. I. G. Akoev. Radiobiologiya, 2: 700-4(1962). (In Russian)

An increase in activity of the thyroid gland is accompanied by activation of erythropoiesis which can be detected by an increase in the take-up of Fe^{59} by hemoglobulin in the erythrocytes. Rats were given a dose of 750 and 850 r of Co^{60} γ-rays, and 2 to 4 months after the irradiation, the rate of incorporation of Fe^{59} was found to be 150 to 190% of the level in the controls. This behavior indicates an increase in erythropoiesis due to the increased destruction of erythrocytes in the peripheral blood. On adding a supplement of 10 and 25 mgs of thyroxine daily to the diet of the rats during the 2nd and 4th months after the irradiation, an increase in the number of erythrocytes in the peripheral blood was observed, and the rate of take-up of Fe^{59} was almost normal. The addition of thyroxine was more effective in females than in males. Treatment with thyroxine during the 4th month was more effective than treatment during the 2nd month after irradiation. It is believed that the addition of thyroxine removes a hormonal deficiency in the organism, and creates conditions which prevent the accelerated destruction of erythrocytes. (TTT)

5884 PHAGOCYTOSIS OF THE BLOOD LEUKOCYTES OF THE DOG DURING THE 5 TO 7 YEAR PERIOD AFTER A CHRONIC EXTERNAL γ-IRRADIATION. L. V. Bogatov. Radiobiologiya, 2: 713-14(1962). (In Russian)

It is known that the resistance of the organism against infection is lowered by exposure to ionizing radiation for periods up to 2 years. It was attempted to determine the phagocytic ability of the leukocytes of the dog during a much longer time period after exposure. Study of 2 groups of dogs, exposed to external γ-ray doses of 10 r/day for an integrated dose of 1300 r and to 18 r/day up to 954 r, indicated that the phagocytic index of the exposed animals is lowered for periods up to 7 years after exposure resulting in a reduced phagocytic protection in spite of the normalization of the leukocytes in the peripheral blood, pointing to a substantial weakening of the natural immunity. (TTT)

5885 THE EFFECT OF THYREOIDINE ON THE RESTORATION OF THE REACTIVITY OF THE ORGANISM AFTER ACUTE RADIATION SICKNESS. M. A. Lagun and V. A. Rezontov. Radiobiologiya, 2: 715-18(1962). (In Russian)

Humans and animals subjected to acute radiation sickness have been found to be unable to withstand stress such as loss of blood, infections, or repeated exposure to x radiation. In order to determine the changes in the pathogenesis of the reactivity of the organism and to estimate the ad-

visability of restoring the hormonal balance by medication, the survival rate of rats was studied under conditions of gas gangrene occurring 2 to 4 months after exposure to γ-radiation in doses of 750 r ($LD_{10/30}$) and 850 r ($LD_{50/30}$). Results showed that 2 to 4 months after exposure the mortality rate of the irradiated rats was higher by a factor of 1.1 to 2.7 than that of the unirradiated ones. In a second test, 2 months after exposure the infection process was aggravated by the suppression of the catalytic activity of the blood. Exhaustion of the thyroid gland was found to play an important role in the pathogenesis of the lowering of the activity; daily introduction of 10 to 25 mg of thyreoidine for periods of 2, 3, or 4 months after the radiation trauma restored the resistance of the rats against gas gangrene practically to the original level. (TTT)

5886 ELECTROENCEPHALOGRAPHIC RECORDING OF FUNCTIONAL INJURIES IN THE CENTRAL NERVOUS SYSTEM CAUSED BY IRRADIATION AND SYMPATHECTOMY. A. M. Stashkov and V. P. Korotkova (Inst. of Experimental Medicine, Leningrad). Radiobiologiya, 2: 719-25(1962). (In Russian)

It was found previously that sympathectomy increases the sensitivity of rabbits to whole-body irradiation of 1000 r for a period of about 2 weeks after the exposure. This behavior was more closely examined by means of an electroencephalograph. Electrodes were introduced in the brain cortex and the hypothalamic region of the rabbits, removing subsequently the upper sympathetic ganglions and exposing the animals to 1000 r of x radiation at a rate of 39.8 r/min. The electrophysiological data thus obtained were correlated with the survival rate and other processes. Irreversible changes were noted in the electroencephalograms in the form of a persisting depression of the biocurrent; similar observations were also noted in several irradiated animals not subjected to sympathectomy. A group of animals was intraperitoneally injected with mercamine at a rate of 150 mg/kg 30 minutes before the irradiation; some of these animals did not exhibit the pathological changes in the encephalogram. It is concluded from the data that this sympathetic nervous system plays a role in the chemical protection against radiation because when the animals were sympathectomized, the protective effect was not observed. (TTT)

5887 SOME CHANGES IN THE INTEROCEPTIVE SYSTEM AFTER EXPERIMENTAL EXPOSURE OF THE HEAD TO X-RADIATION. N. S. Delitsyna. Radiobiologiya, 2: 726-31(1962). (In Russian)

In 5 previous publications the author reported that whole-body irradiation of animals causes marked changes in the central nervous system. This series of studies is further extended by investigating the effect of local irradiation of the head alone. The heads of rabbits were exposed to 1000 and 3000 r at a rate of 144 r/min, examining the effect by means of stainless steel electrodes imbedded in the skull bone. Results indicated changes in the central and peripheral members of the nervous system. At both exposure levels the effect of respiration was indicated by rythmic oscillations; this is rarely noted in irradiation experiments. Comparison with previous data revealed that total exposure causes more marked injuries in the central portions of the nervous system, showing a somewhat weaker effect in the peripheral portion than that caused by the exposure of the head. These differences are most noticeable during the first few days after the irradiation. (TTT)

5888 ELECTROPHYSIOLOGICAL AND ELECTRONMICROSCOPIC STUDY OF CERTAIN FEATURES OF X-RADIATION INDUCED EARLY INJURIES. V. S. Petrov (Bekhterev Psychoneurological Scientific Research Inst., Leningrad). Radiobiologiya, 2: 732-40(1962). (In Russian)

Electroencephalographic, electron microscopic, and optical measurements were carried out on portions of the cortex of the brain and the hypothalamic tissue of mature white rats in order to clarify the role of the early, radiation-induced morphological changes in brain function disorders. The animals were exposed to an integral dose of 600 r at a rate of 12.7 r/min. The electric activity of the brain was recorded before and after the exposure by means of needle-shaped electrodes placed in the lobar, central, and occipital areas, recording simultaneously the breathing and the cardiac activity. Results indicated that whole-body exposure to x radiation induces functional and submicroscopic changes in the nervous tissue of the brain. The increase of the electric activity of the brain, heart, and the breathing apparatus with subsequent impairment of the breathing function is accompanied by the disorganization of the mitochondria of the ergastoplasmic and vascular membranes and the rearrangement of the ribonucleoproteins in the cytoplasm, in the nuclei of the neurons, nerve fibers, the cortical blood vessels, and the hypothalamus. The submicroscopic degradation of these organs represents the primary reaction of the brain tissue to radiation. (TTT)

5889 CHANGES IN THE REACTIONS OF THE NERVOUS SYSTEM OF ANIMALS REPEATEDLY EXPOSED TO INTERNAL RADIATION UNDER HYPOTHERMIA. V. P. Godin. Radiobiologiya, 2: 741-8(1962). (In Russian)

The effect of repeated exposures to internal radiation at normal body temperature and under refrigeration on the reflex actions of the animal was investigated by introducing perorally 50 microcuries of Na^{24} once per month for 6 months into male white rats a number of which were subjected to a 10-hr long refrigeration to 0°C after the administration of the radioactive solution. Results indicated that the effects of the repeated exposures are additive; the reaction of the nervous system to this treatment involves several phases. The reflex time was shortened by 3 monthly exposures but was lengthened upon continuing the tests for 6 months. The combined action of repeated internal irradiation and cooling treatments caused first an enhancement of the radiation effect followed by a normalizing action caused by the refrigeration. (TTT)

5890 THE INFLUENCE OF RADIATION-INDUCED CHROMOSOMIC ABERRATIONS ON THE VIABILITY OF CANCEROUS CELLS. I. M. Shapiro and Z. N. Faleeva (Severtsov Inst. of Animal Morphology, Moscow). Radiobiologiya, 2: 749-57(1962). (In Russian)

In investigating the rate of growth of cancerous cells, special attention was paid to the viability of cells exhibiting radiation-induced chromosomic rearrangements. The studies were carried out with transplanted ascitic Ehrlich cancer cells. Comparison of the survival rate of mice into which these cells were transplanted and the percentage of cells having chromosomic aberrations indicated that the number of the surviving animals decreases linearly with the logarithm of the implanted cells; the larger the radiation dose to which the cells were subjected prior to inoculation, the larger was the number of surviving animals. The percentage of cells not exhibiting chromosomic rearrangements, i.e., the reciprocal of those with aberrations, also showed a logarithmic correlation with the dose. Thus, radiation-induced aberrations are considered lethal for the cells. The percentage of cells exhibiting rearrangements may possibly be used as a biological criterion for determining the dose in the radiotherapy of malignant tumors. (TTT)

5891 THE EFFECT OF AMINO ETHYLISOTHIURONIUM BROMIDE HYDROBROMIDE ON THE RADIATION DAMAGE OF THE MUCOUS MEMBRANE OF THE SMALL INTESTINE. I. B. Smirnova (Severtsov Inst. of Animal Morphology, Moscow). Radiobiologiya, 2: 768-72(1962). (In Russian)

The gastro-intestinal tract and in particular the small intestine of mammals is one of the most radiation-sensitive systems of the organism and injury to it strongly influences reaction to radiation injury. Thus, introduction of amino ethylisothiuronium Br • HBr (AET) reduces the number of cells exhibiting chromosome aberrations in the intestine of irradiated animals. A previously proposed quantitative method for estimating the extent of the injury and the degree of recovery of the mucous membrane of the small intestine was further investigated; AET was used as protective agent as its action does not involve the oxygen effect, although it is not completely clarified yet. White mice were exposed to the minimum lethal dose of 700 r and to 1300 r, the intestinal dose. Injury to the small intestine was found to be nearly identical in both cases during the first few days but recovery was noted only after exposure to 700 r. Injection of AET resulted in an excellent morphological protection of the intestine, as indicated by the reduction of the number of cells exhibiting chromosome aberrations and by the increase of the mitotic index. It is of interest to note that after 3 days the mitotic index of the protected animals exposed to 700 r was somewhat reduced; this is probably due to the ability of AET to cause an increase of pathological mitoses in unirradiated animals. (TTT)

5892 TOMATO MUTANTS INDUCED BY γ-RADIATION AND BY ETHYLENE IMINE. V. V. Khvostova, V. D. Turkov, L. I. Voronkova, and L. V. Nevzgodina. Radiobiologiya, 2: 790-8(1962). (In Russian)

Experiments currently under way on mutants in wheat indicated that ethylenimine possesses a stronger mutagenic effect than γ-radiation; this study was extended to the tomato in order to compare the effect of these factors in another culture. Seeds of Snigirevskiĭ-22 type tomato were exposed to 20, 30 and 40 kr of γ-radiation and were treated with 0.01, 0.02, 0.03 and 0.04% ethylenimine solutions. Subsequent hot-house cultivation of the seeds indicated that the 40-kr dose has lethal effect while the 20-kr dose stimulates the growth; treatment with 0.04% ethylenimine solution reduced the survival rate by 32.5%. Most of the changes observed were hereditary. The γ-radiation induced 155, the chemical treatment 70 mutants several of which may find agricultural application. (TTT)

5893 POST-IRRADIATION PROCTITIS, A COMPLICATION OF RADIOLOGICAL TREATMENT OF CANCER OF THE UTERINE CERVIX. G. Collo and G. Viviani. Radiol. Med., 48: 1216-27(Dec. 1962). (In Italian)

After examining the causes that may take part in determining post-irradiation proctitis, the results are reported on a rectoscopic study on 97 patients all suffering from cancer of the uterine cervix and those of the endocavitary dosimetric measurements, which show that the anterior wall of the rectum is affected to the greatest extent by the radiations, for a tract at 5 to 10 cm from the anal orifice. Various pathological findings of post-irradiation proctitis are illustrated and prophylactic therapy of post-irradiation proctitis in all cases of cancer of the uterus undergoing radiotherapy is discussed. (auth)

5894 ULTRAVIOLET RADIATION AND NUCLEIC ACID. R. A. Deering. Sci. Am., 207: No. 6, 135-8; 140; 142; 144(Dec. 1962).

Recent studies on the interaction of ultraviolet radiation and molecules of desoxyribonucleic acid (DNA) are reviewed. Evidence is presented that ultraviolet can change DNA in specific ways and can partially reverse these changes. Both forward and backward alterations have been demonstrated in DNA function. Evidence is presented that much of the damage that ultraviolet radiation inflicts on cells and viruses is caused directly by its effects on DNA. Reaction mechanisms involved are discussed. (C.H.)

5895 RECOVERY FROM RADIATION-INDUCED DELAY OF CLEAVAGE IN GAMETES OF ARBACIA PUNCTULATA. Patricia McClement Failla (Argonne National Lab., Ill.). Science, 138: 1341-2(Dec. 21, 1962).

A decrease in delay of cleavage, when irradiated sperm from Arbacia punctulata were allowed to recover inside eggs, occurred when cell division was interrupted by the removal of oxygen soon after fertilization. The recovery mechanisms in irradiated eggs of this species before and after fertilization were compared and appear to differ. (auth)

5896 THE EFFECTS OF RADIATION THERAPY ON THE EAR; WITH PARTICULAR REFERENCE TO RADIATION OTITIS MEDIA. Steven J. Borsanyi (Univ. of Maryland, Baltimore). Southern Med. J., 55: 740-3(July 1962).

Between 1957 and 1961 over 100 patients who were treated by a Co^{60} teletherapy unit for malignant tumors of the head and neck were observed. The ears were included in the field of irradiation (4000 to 6000 r to the region of the inner ear). Between 50 and 60% of the patients developed ear symptoms during or shortly after completion of treatment. The most common symptoms were a sensation of fullness in the ear, some loss of hearing, earache, and tinnitus. Examination of ears revealed mild to moderate hyperemia of ear drums, with slight retraction in early stages and bulging at later stages. There was a moderate conductive hearing loss also. This disease entity is termed radiation otitis media and its pathophysiologic mechanism is similar to that of serous otitis media. Sterile fluid fills the middle ear, containing also some desquamated epithelial cells. Radiation otitis media usually clears up in a few weeks after the completion of treatment. In the management of this condition, vasoconstrictors, mild analgesics, and gentle politzeration were sufficient. However, in a few cases bacterial invasion of the sterile fluid occurred, resulting in purulent otitis media which required the use of antibiotics. Hearing of 20 patients was tested at weekly intervals during and after the completion of radiation. Out of the 40 ears, 16 showed a conductive hearing loss, averaging 20 db. Six ears showed a worsening of the original loss of preceptive hearing. However, this was also primarily due to the development of a conductive component. There were no microscopically detectable immediate changes in the cochlea or labyrinth exposed to radiation in cancerocidal doses. (H.H.D.)

5897 THE INFLUENCE ON EMBRYONAL DEVELOPMENT OF MICE OF ROENTGEN IRRADIATION. Heinz Kriegel, Hanns Langendorff, and Kyoko Shibata (Universität, Freiburg i. B. and Heiligenberg-Instituts, Ger.). Strahlentherapie, 119: 349-70(Nov. 1962). (In German)

Investigations were made on mice concerning the influence of ionizing radiation upon the embryonal development. The animals received 200 r total-body irradiation during the days of the formation period of the main organs. Furthermore, the dose dependence of the embryonal damage at the 5th and 8th day of pregnancy was investigated, using x-ray doses between 50 and 400 r. Most serious deformities caused by an irradiation insult occurred in the first

half of the development period of the organs. Significant brain defects as well as ventral cleft defects were observed. Investigations of the dose dependence of the embryonal damage showed that at a radiation burden of 300 r at the 5th day post conception 50% of the fetuses showed anomalies in development. The same effect was obtained with 150 r by the 8th day of pregnancy. The results are discussed in connection with an ability for recovery of the produced damage during the embryonal development. (auth)

5898 RADIOBIOLOGICAL INVESTIGATION OF SIEVE AND SCREEN IRRADIATION. PART 4. EXPERIMENTAL ANIMAL STUDIES OF THE IMPORTANCE OF THE PERCENTAL OPENING FOR THE SKIN-PROTECTION EFFECT OF SIEVE IRRADIATION. Ludwig Rausch (Universität, Marburg, Ger.). Strahlentherapie, 119: 371-7(Nov. 1962). (In German)

The importance of the percental opening for skin protection was investigated as a part of an experimental study on the radiobiology of sieve irradiation, using the perforation-hole healing-test on the rabbit ear. In agreement with results obtained by other authors using another model an improvement of the skin protection with decreasing percental opening was shown. (auth)

5899 INVESTIGATIONS WITH IONIZATION CHAMBERS FOR DETERMINATION OF ISODOSE OF PENDULUM IRRADIATION WITH ULTRAHARD X RAYS OF A 15-Mev ELECTRON CENTRIFUGE BETATRON. PART VII. ON THE DEPENDENCE OF ISODOSE ON THE VARIOUS FIELD SIZES. Franz Heinzler and Harald L. Mohr (Inst. and Clinic for Medical Radiation Science, Düsseldorf Medical Academy, Ger.). Strahlentherapie, 119: 378-88(Nov. 1962). (In German)

The isodoses of ultrahard x rays from the 15.5 Mev betatron of the Siemens-Reiniger-Werke were determined for different field sizes at a constant pendulum angle of ±90° and at a pendulum axis depth of 8 or 10 cm using ionization chambers. Body-like water phantoms Nr. 822 and 808 a of the Physikalisch-Technischen Werkstaetten (thorax or abdomen of young people and adults) were used. Isodose graphs and their values are given and compared with the values of the lead filters as well as with the fields used. These values can be used for preparation of the irradiation plan. (auth)

5900 ON THE MECHANISM OF GLYCOLYSIS HINDRANCE IN ASCITES TUMOR CELLS BY X RAYS. II. RELEASE OF THE GLYCOLYSIS HINDRANCE BY UNSPECIFIC CELL TOXIN. Klaus Dose (Max-Planck-Institut fur Biophysik, Frankfurt am Main). Strahlentherapie, 119: 419-24(Nov. 1962). (In German)

An unspecific cell-toxin of the type of 2-octanol, damages the energy-producing metabolism (anaerobic glycolysis) in ascites tumor-cells in a similar way as x rays do in the dose range between 10 and 100 kr. General consequences of these observations are discussed. (auth)

5901 INVESTIGATION OF CALCIUM EXCHANGE IN THE EPI- AND METAPHYSIS AFTER LOCAL X IRRADIATION. PART IV. THE RESORPTION. Jaromír Kolár and Arnost Babicky (Universität, Prague and Tschechoslowakischen Akademie der Wissenschaften, Prague). Strahlentherapie, 119: 435-41(Nov. 1962). (In German)

After previous experiments about incorporation of radioactive calcium, the conditions concerning resorption after local radiation damage were investigated also. Additionally, in the case of resorption, depressions after radiation influence and signs of a general reaction in the skeletal system of the irradiated animal, could be observed. (auth)

5902 THE EEG AFTER FRACTIONAL IRRADIATION OF THE BRAIN. Werner Ruebe (Freien Universität, Berlin). Strahlentherapie, 119: 442-61(Nov. 1962). (In German)

Electro-encephalographic changes of the brain during and after fractionated irradiation with x rays are reported. The importance of the "immediate effect" appearing during irradiation to the pathogenesis of the physiological behavior and to the true irradiation damage is discussed. The practical importance of the experimental results obtained in guinea pigs is discussed using an example of the human EEG obtained after irradiation of the hypophysis. The physiological and reproducible functional behavior of the biopotentials of the brain after x-ray irradiation seems to be suitable as model for further radiobiological investigations. (auth)

5903 REACTION OF VARIOUS TYPES OF WHEAT AND BARLEY TO IRRADIATION BY COBALT. Ya. A. Ivanov and B. N. Kulikov (Kirgiz Frunze Scientific-Research Inst. of Agriculture, USSR). Tsitologiya, 2: 736-9(1960). (In Russian)

The results of experiments carried out with various types of soft wheat and barley seed at identical Co^{60} gamma doses showed distinct differences in chromosome construction and radiosensitivity. A direct relation was established between the radiosensitivity of various varieties and the degree of chromosome reconstruction in their roots. (R.V.J.)

5904 HISTOLOGIC AND HISTOCHEMICAL CHANGES IN RABBIT KIDNEY AFTER ROENTGEN IRRADIATION. F. Papousek, J. Svejda, and J. Kotas (Univ. of Brno). Zentr. Allgem. Pathol. Pathol. Anat., 103: 541-6(Aug. 8, 1962).

The kidney of rabbits was irradiated with 5000 r and examined 18 hr to 46 days later. Relatively slight changes were noted during the early postirradiation period when routine histologic techniques were used. At this period, hyperemia was the principal finding. After 5 to 7 days, elastic fibers of blood vessel walls were fragmented and interstitial reticulin fibers were swollen and stained poorly with silver. Histochemical methods showed a depletion of sulfhydryl and disulfide groups in parenchymal tissue. Esterase activity was low by the 5th day, then returned to normal. Lipase activity was increased from 18 hr to the 9th day, after which it declined. Pyruvic dehydrogenase showed a decrease 18 hr to 9 days after irradiation and a return to normal by the 18th day; changes in cytochrome oxidase were similar. Both alkaline and acid phosphatases showed an immediate rise in activity, which reached a max. on the 7th day. Then acid phosphatase fell sharply on the 9th day and alkaline phosphatase on the 12th day. Thereafter the activities of both enzymes rose gradually to normal levels. The histochemical results with these 2 enzymes were confirmed by chemical assays on kidney. Functional disturbances in kidney were reflected by increased urinary excretion of non-protein nitrogen after irradiation. This was seen morphologically at late postirradiation stages by fibrosis and loss of functioning tubules. It is suggested that the rise in lipase activity after irradiation resulted from increased demands for lipid transport in degenerating tissue. The impairment of activity of the respiratory enzymes (pyruvic dehydrogenase and cytochrome oxidase) indicates mitochondrial injury, which was evident at an early stage. (H.H.D.)

5905 DEISTVIE IONIZIRUYUSHCHIKH IZLUCHENII NA RASTENIYA. RADIOFIZIOLOGICHESKIE IZZLEDOVANIYA. (Ionizing Radiation Effects on Plants. Radio-

physiological Studies). I. M. Vasil'ev, Moscow, Publishing House of the Academy of Sciences, 1962. 224p.

A survey of radiophysiology of plants is divided into four sections. The first section describes the initial stages of ionization and excitation of cells resulting in structural changes and disturbances if physiological and chemical functions. The second section examines subsequent radiation sickness processes pronounced in the life-activity that often destroy or kill the exposed organism. The third section on plant radiosensitivity analyzes the initial and subsequent stages of radiation injury and surveys plant reactions to various conditions and types of radiation exposure. The fourth section examines radioisotope applications in agriculture, and the effects of radiation on the growth and development of plants. An extensive reference list is included. (R.V.J.)

5906 RADIATION AND HEALTH. Katharine Williams, C. L. Smith, and H. D. Chalke. London, Longmans, Green and Co. Ltd., 1962. 212p.

The effects of radiation on man are reviewed for the layman. Topics discussed include physics and nomenclature, radiation measuring and monitoring, the use of radiations and radioactive materials in industry and hospitals, hazards to the population from clinical uses of radiation, Sr^{90} levels in human food, dose rates to man from natural background and other sources of radiation, the disposal of radioactive wastes, and public health aspects of radiation. (C.H.)

5907 STRONTIUM 90 INDUCED BONE AND BONE-MARROW CHANGES. AN EXPERIMENTAL STUDY WITH SPECIAL REFERENCE TO THE HISTOGENESIS AND HISTOPATHOLOGY OF OSTEOSARCOMAS. Agnar Nilsson (Research Inst. of National Defence, Sundbyberg, Sweden and Royal Veterinary Coll., Stockholm). Uppsala, Almqvist and Wiksells Boktryckeri AB, 1962. 19p. (A/AC.82/G/L.784). (In English)

The histogenesis and histopathology of Sr^{90}-induced osteosarcomas were studied in mice following a single intraperitoneal dose of 0.67 μc of Sr^{90}/g body weight. Radioautograms were prepared of whole mice at various times after the administration of Sr^{90}. Ninety percent of the 200 injected mice developed osteosarcomas from 181 to 462 days after injection, 4% developed metastases, and 5% of the non-tumor bearing mice developed leukemia. (C.H.)

Radiation Sickness

5908 (SAM-TDR-62-68) FURTHER STUDIES ON THE DISTRIBUTION AND METABOLISM OF 2-MERCAPTOETHYLGUANIDINE AND BIS(2-GUANIDOETHYL) DISULFIDE IN MICE. Bernard Shapiro, Emanuel E. Schwartz, and George Kollmann (Albert Einstein Medical Center. Radiology Dept., Philadelphia). June 1962. Contract AF41(657)-300. 14p.

The distribution and chemical forms of S^{35}-labeled MEG and GED in the tissues of protected C57BL male mice were studied. Results were obtained at 20 minutes after intraperitoneal injection of 140 and 280 mg/kg MEG and at 20, 60, and 120 minutes after intraperitoneal injection of 140 mg/kg GED. Protein-bound S^{35}, GED, taurocyamine, guanidoethane sulfinic acid, MEG, and sulfate were identified in the tissues. Protein-bound S^{35} and GED decreased at 120 minutes and correlated best with protection of the mice. All other products increased or were unchanged at 120 minutes. These results suggest that one or both of these forms is directly involved in radiation protection. (auth)

5909 (TID-14019) THE RATE OF RECOVERY FROM RADIATION INJURY AS A FUNCTION OF INJURY. Howard H. Vogel, Jr., John W. Clark, and Donn L. Jordan (Argonne National Lab., Ill.). Aug. 1961. Contract [W-31-109-eng-38]. 18p. (UAC-5554)

The rate of recovery from radiation injury was tested by the use of split-dose experiments using both fission neutrons and Co^{60} γ-rays. Mice were exposed to sublethal doses of these external radiations. Then, after an interval of 5 days in the γ-ray experiments and 10 days in the neutron exposures, the amount of additional radiation necessary to kill some of the animals, within a month, was determined. The hypothesis was supported that the rate of recovery from radiation injury was a function of the injury present, or the size of the dose. Recovery appeared to be exponential. Repair rates were slower after comparable exposures to fission neutrons than to γ-rays from Co^{60}. In both cases the fraction of latent damage repaired decreased progressively as the dose increased. These data are compared with similar x-ray data of Storer which support the hypothesis that the recovery rate actually decreased inversely with the square of the dose. The data for all three radiations show a progressive retardation of the repair constant as the dose is increased, certainly for exposures higher than one-half the $LD_{50/30}$ dose. (auth)

5910 (TID-17379) FACTORS ELABORATED BY ANIMAL TISSUES WHICH STIMULATE RATE OF REGENERATION OF HEMATOPOIETIC ORGANS OF ANIMALS EXPOSED TO TOTAL BODY IRRADIATION WITH GAMMA RAYS. Final Summary Report. D. H. Kaump (Parke, Davis and Co., Detroit). Nov. 21, 1962. Contract AT(11-1)-334. 35p.

The protective effects of 47 compounds against radiation injury to the hematopoietic system were tested in rats. Several routes of drug administration, different times of drug administration, and various radiation doses from two Co^{60} γ sources were used. There was some suggestion of survival enhancement, but no response in the bone marrow nucleated cell count, when nucleic acid precursors were given soon after a radiation dose of 840 to 860 r. (C.H.)

5911 (JPRS-16471) THE USE OF STREPTOMYCIN IN THE PREVENTION OF ACUTE RADIATION SICKNESS. L. F. Semenov. Translated from Antibiotiki, 7: 912-16 (1962). 10p.

A single prophylactic administration of streptomycin, dihydrostreptomycin, and a mixture of streptomycin with penicillin, immediately prior to irradiation exerted no protective effect against radiation injury. Simultaneous combination in the prophylaxis of radiation sickness of sulfur-containing or amino-containing agents with streptomycin reduced their protective antiradiation effect. Therapeutic administration of streptomycin, starting on the 2nd day following irradiation exerted a positive effect and increased the effect of prophylactic protective agents in mice. (auth)

5912 THE PATHOMORPHOLOGY OF THE HEART MUSCLE IN EXPERIMENTAL RADIATION DISEASE IN RABBITS. Stanisław Kośmider, Zbigniew Szczurek, and Tadeusz Petelenz (Silesian School of Medicine, Zabrze, Poland). Arch. Immunol. Therap. Exptl. (Warsaw), 10: 459-72(1962).

Rabbits were irradiated with single doses of 200, 500, 700, or 1000 r and heart muscle was examined 10 to 20 days later or after earlier spontaneous death. Macroscopically, dilatation of the heart cavities was observed in

most of the animals. Disorders of circulation and degenerative and proliferative changes were also observed. Circulatory disorders included congestion, extravasation of blood cells, or more rarely hemorrhage, hyaline thrombosis, and infiltration composed of lymphocytes and neutrophilic leukocytes. These changes were not strictly correlated with the magnitude of the dose. The most frequent degenerative changes consisted in obliteration of the transverse striations, parenchymal clouding, and granular degeneration of muscle fibers; more rarely, fragmentation, vacuolar degeneration, and fatty and focal necrosis associated with extravasation. Degenerative changes occurred independently of the magnitude of the radiation dose, although they were more intense after higher doses. Proliferative changes and fibrosis were comparatively rare. Nuclei as seen by routine histopathologic methods showed no injury. However, the Feulgen method for deoxyribonucleic acid revealed in all the irradiated animals, independently of the dose, a distinct reduction. This reduction was approximately the same at all doses. Lesions in veins and coronary arteries were present in a few animals irradiated with medium or large doses, in the form of proliferation of the endothelium or connective tissue in the intima. The observed lesions, contrary to other reports, indicate the possibility of direct injury to myocardium by ionizing radiation, as shown by degenerative changes and decrease of deoxyribonucleic acid in nuclei. The degenerative changes were at first reversible, although after larger doses irreversible necrosis occurred, leading to granulation, fibrosis, and scar formation in the myocardium. These changes were observed even after 200 r. These findings indicate that irradiation first injures cell nuclei and sarcoplasm of muscle fibers, these lesions being intensified by accompanying disorders of circulation due to injury of the capillary vessels. (H.H.D.)

5913 IRON METABOLISM IN EXPERIMENTAL RADIATION SICKNESS. G. V. Voskoboynikov (Central Research Inst. of Medical Radiology, Leningrad). Biochemistry (USSR) (English Transl.), 27: 52-6(July-Aug. 1962).

The results of metabolic studies of iron in irradiated organisms are presented. Experimental evidence showed that the accumulation of non-hemin iron in the tissues of irradiated animals exhibits a phasic course being effected mainly through its accumulation in the hemosiderin fraction. A discussion is also presented on the tentative causes of excessive iron accumulation in irradiated tissues. (auth)

5914 THE ASSOCIATION OF ADENOSINE TRIPHOSPHATE + DIPHOSPHOPYRIDINE NUCLEOTIDE IN THE RADIOPROTECTION OF THE EMBRYONIC CELL. L. Verga and F. Coucourde (Università, Pavia, Italy). Boll. Soc. Ital. Biol. Sper., 37: 1171-3(Dec. 15, 1961).

Chick embryos were irradiated with 180 r on the 60th hr of incubation. Some of the embryos were injected 1 hr earlier with 300 mg glucose-1-phosphate + glucose-6-phosphate, 250 mg adenosine triphosphate (ATP), or 250 mg ATP + diphosphopyridine nucleotide (DPN). Examination of the heart on the 64th hr showed that none of the control irradiated embryos or those injected with glucose phosphates survived. In contrast, 50% of those injected with ATP and 70% of those injected with ATP + DPN showed heart beats. Irradiation alone caused a drop of mitotic activity in cardiac cells to one-tenth normal, and ATP + DPN practically abolished this drop, ATP being slightly less effective. The glucose phosphates had almost no effect in maintaining mitotic activity after irradiation. It is suggested that essential high-energy metabolites and cofactors may preserve cellular function after destruction of energy-yielding metabolic processes by radiation. (H.H.D.)

5915 THE MECHANISM OF INHIBITION OF ACUTE X-RAY DAMAGE TO GUINEA PIG SKIN BY CORTISONE. P. G. Mellett, J. B. Walter, and L. E. Houghton (Harefield Hospital, Harefield, Middx., Eng.). Brit. J. Exptl. Pathol., 42: 212-21(June 1961).

Adult guinea pigs were exposed to an x-ray dose of ~5000 r over a circular field 2.6 cm in diameter on both flanks. Some of the animals were given daily injections of 10 mg/day cortisone acetate for 42 days following irradiation. Radioinduced hair loss was delayed in cortisone-treated animals. Desquamation occurred in all animals between the 20th and 40th days after irradiation; some animals of both groups showed epidermal ulcers at this stage. Deep ulceration of all layers of the skin was shown by control animals by the 49th day, but deep ulceration was markedly delayed in cortisone-treated animals. In the interval between superficial and deep ulceration, cortisone-treated animals showed rampart rings (due to hyperplastic hair follicle cysts) for long periods. Hyperplasia of epidermis between superficial and deep ulceration was not diminished in cortisone-treated animals; the hyperplastic epidermis was maintained. Deep ulceration, when it occurred in control or, after cessation of treatment, in cortisone-treated animals, was preceded and accompanied by degenerative changes in arterioles. While abnormal fibroblasts were seen in the dermis of control and cortisone-treated animals, fibrosis was not excessive. It is suggested that deep ulceration was caused by blood vessel degeneration. The hypothesis that vascular connective tissue is damaged by direct radiation injury and that such damage is prevented by cortisone is proposed. Cortisone acts on the long-term process of post-irradiation change in tissues, and it is suggested that, where cortisone is used as an adjunct to radiotherapy for the prevention of damage to normal tissue, it must be given in adequate doses for very long periods. (H.H.D.)

5916 ACTIVE AND PASSIVE IMMUNITY TO TRANSPLANTATION OF FOREIGN BONE MARROW IN LETHALLY IRRADIATED MICE. J. F. Loutit and H. S. Micklem (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Brit. J. Exptl. Pathol., 42: 577-86(Dec. 1961).

Studies were undertaken to extend information on the bone-marrow treatment of pre-immunized irradiated mice, and to discover whether destruction of injected bone-marrow cells in the mice was due to a cell-mediated or humoral reaction. It was shown that immunity to injected marrow suspensions could be passively transferred by means of specific antisera, and that the amount of antiserum needed may be very small. Mice from 3 highly inbred strains (CBA, A, C3H) were actively immunized against the iso-antigens of other inbred strains. In addition, C57BL female mice were actively immunized against the iso-antigens, determined by the Y-chromosome, of C57BL males. They were then given a lethal dose of x rays followed by an injection of bone marrow from donors of the strain against which they had been immunized. In these circumstances the bone-marrow therapy, which saved non-immune control mice from acute radiation death, was ineffective. In 2 strain combinations, in which there was considerable antigenic disparity between donor and host, immunity could be transferred by injecting serum from immunized donors intravenously. As little as 0.004 ml of immune serum was effective. It was concluded that serum antibodies alone were able to mediate immunity to trans-

planted bone marrow. In a 3rd strain combination, where donor and host had the same antigens determined by the H-2 histocompatibility locus, passive immunity was not demonstrated. In this case, effective immunity may have required the presence of sensitized cells. (H.H.D.)

5917 THE TREATMENT OF ACUTELY X-IRRADIATED MICE WITH STREPTOMYCIN AND DERIVATIVES OF 6-AMINOPENICILLANIC ACID. T. L. Fallowfield (Medical Research Council, Harwell, Berks, Eng.). Brit. J. Exptl. Pathol., 43: 44-7(Feb. 1962).

A comparison was made between the therapeutic effects of 2 derivatives of 6-aminopenicillanic acid (potassium phenethicillin and methicillin), benzyl penicillin (penicillin G), and streptomycin, in mice given lethal doses of x rays (700 to 1000 r). The LD_{50} in the untreated group was 806 r. None of the antibiotic treatments significantly increased the LD_{50} and one, phenethicillin, appeared to decrease it. Survival time was affected by antibiotic treatment, though in the mice given subcutaneous streptomycin there was a slight prolongation of life not exceeding 2 days. A significantly larger number of deaths occurred in the phenethicillin and methicillin groups than in the control group. The mortality in the streptomycin group was indistinguishable from that of the controls. There were no significant differences in the times to death. The complete failure of streptomycin is at variance with earlier reported results. It is suggested that previous experimental mice may have been infected with streptomycin-sensitive pathogens and that radiation might have caused a flare-up of the hitherto quiescent infection, explaining the favorable action of antibiotics. Thus, streptomycin, or any other antibiotic, can only be expected to be effective if death after irradiation can be attributed to infection. The apparent toxicity of derivatives of 6-aminopenicillanic acid is unexplained. As no toxic effect was found in normal animals at amounts 25 times as large; they may cause a potentiation of the effects of radiation on the basis of their chemical nature. (H.H.D.)

5918 RADIATION SICKNESS: AN ANALYSIS OF OVER 1000 CONTROLLED DRUG TRIALS. Basil A. Stoll (Peter MacCallum Clinic, Melbourne). Brit. Med. J., 2: 507-10(Aug. 25, 1962).

In 1042 irradiated patients drug trials were conducted in attempts to assess the relative value of central sedatives (mainly phenothiazines) as compared with pyridoxine and a relatively inert group of drugs. The phenothiazines used were of the older type (chlorpromazine, prochlorperazine, thiopropazate, fluopromazine, pecazine) as well as of the newer type (trifluoperazine, haloperidol). The relatively inert drugs included cyclazine, amphetamine, diphenylhydramine, and lactose. For nausea, the predominant symptom, pyridoxine, the older phenothiazines, and the newer tranquilizer groups are all significantly superior to the inert drugs. The newer tranquilizers are superior to all others, but there is no statistical difference between pyridoxine and the older phenothiazines in the relief of nausea. For vomiting and listlessness, a similar superiority of the newer tranquilizers is shown. In the case of anorexia, however, pyridoxine and the older phenothiazines are superior to the inert group but the newer tranquilizers are relatively less effective. For all drugs used in radiation sickness, anorexia is the most difficult symptom to relieve possibly because its control lies in the appetite center, separate from the vomiting center. Possibly some other factor also enters into its control, such as the loss of taste. Haloperidol and trifluoperazine assessed separately showed no statistical difference in their relative efficacy in any symptom including anorexia. Radiation of the abdomen and pelvis causes more severe radiation sickness, and inert drugs give, in general, less relief of symptoms arising from radiation of this area than of other parts. All the drugs were less efficacious when radiation is given to the abdomen and pelvis, although not at a significantly statistical level. In comparison of the efficacy of each group for irradiation both above and below the diaphragm, the newer tranquilizers appear significantly superior to all others. For nausea arising in 265 cases of breast irradiation, the new tranquilizers are significantly superior to all others. Anorexia after irradiation may originate in the appetite center or have a different cause such as delayed gastric emptying. Separate origins for vomiting and for anorexia may account for the superior effect noted with the newer tranquilizers on the symptoms of nausea and vomiting and the greatly inferior effect on anorexia. The tranquilizers may act by sedating the vomiting center. Evidence was found for a specific deficiency of pyridoxine in some cases of radiation sickness. Whether this is a direct effect on enzymes, an effect on the bowel, or a result of metabolic changes associated with vomiting is uncertain. Nevertheless pyridoxine may be of value even if other anti-emetic drugs fail to control the symptoms of radiation sickness. (H.H.D.)

5919 THE MECHANISM OF THE PROTECTION OF YEAST CELLS AGAINST THE EFFECTS OF X RAYS BY TETRAHYDROXYQUINONE AND NEIGHBORING COMPOUNDS. Jean-Louis Seris and André Bru (Faculte des Sciences, Toulouse). Compt. Rend., 255: 1027-9(July 30, 1962). (In French)

The protective effect of tetrahydroxyquinone (THQ) can be extended to rhodizonic acid and to hexyhydroxybenzene. The protection is connected to oxyreduction properties. The penetration of THQ to the interior of the cytoplasm was established. (tr-auth)

5920 EXPERIMENTAL BASIS FOR BONE MARROW TRANSPLANTATION AFTER WHOLE-BODY IRRADIATION. Gunther Barth (Medizinische Universitätsklinik, Erlangen, Ger.). Deut. Med. Wochschr., 86: 1331-3 (July 14, 1961).

Results of animal experiments showing the feasibility of the technique are reviewed. (H.H.D.)

5921 CLINICAL RESULTS OF BONE MARROW TRANSFUSIONS. S. Witte (Medizinische Universitätsklinik, Erlangen, Ger.). Deut. Med. Wochschr., 86: 1334-7 (July 14, 1961).

The results of marrow transplants in 54 cases are described. In 5 cases, transplantation was carried out after lethal doses of radiation (650 to 1000 rem), and in other cases after treatment of cancer with cytostatic agents, in aplastic anemia, and in leukemia. The technique utilized multiple puncture and aspiration from sternum and ilium of homologous marrow containing up to 10^{10} cells. The results were generally favorable after irradiation or cytostatic therapy but unsatisfactory in idiopathic aplastic anemia. In 18 cases of leukemia treated with high intravenous doses (3 mg) of trisethyleneiminophenylquinone, bone marrow transplants afforded complete remission in 4 cases for 2–21 months and partial remission in 4 other cases for 4–12 weeks. (H.H.D.)

5922 CHEMICAL PROTECTION OF RAT THYMOCYTES IRRADIATED IN VITRO. G. A. Grant and O. Vos (National Defence Research Organization T.N.O., Rijswijk (Z. H), Netherlands). Intern. J. Radiation Biol., 5: 413-25 (Sept. 1962). (In English)

The effect of chemical compounds on the survival of rat

thymocytes irradiated in vitro was studied. The oxygen-concentration of the treated and untreated cell-suspension was also determined. The addition of cysteine, l-dimethyl-cysteine, isocysteine, cysteamine, and S-2 aminoethyl-isothiuronium bromide hydrobromide (AET) to the suspensions appreciably retarded the death-rate of the irradiated cells, but did not reduce the oxygen-content of the suspensions to a level which could be expected to affect their radiosensitivity. It was concluded that these compounds protect by reacting with radiosensitive sites in the cell and not by causing anoxia in cells or radiosensitive organs. Cystamine, β-homocysteine, adrenaline, and histamine were ineffective with regard to the death-rate and depleting the cell-suspension of oxygen. Since these compounds are radioprotective in vivo it is proposed that they have a pharmacological mode of action and therefore do not protect by reacting with the radiosensitive sites in the cells. The different effect of cystamine in vivo and in vitro may also be explained by its conversion to cysteamine, which may occur in vivo but not in vitro. Noradrenaline, diethyldithiocarbamate, d- and dl-dimethyl-cysteine, α-homocysteine, and glutathione were found to interfere with the eosin-staining technique employed to determine the number of non-viable cells, but have been classified as non-protectors at the cellular level. (auth)

5923 THE USE OF SULPHUR AS A PROTECTING AGENT AGAINST IONIZING RADIATIONS. A. Charlesby, P. G. Garratt, and P. M. Kopp (Royal Military Coll. of Science, Shrivenham, Wiltshire, Eng.). Intern. J. Radiation Biol., 5: 439-46(Sept. 1962). (In English)

Many sulfur-containing compounds are known to be effective radiation protectors in biological systems. Experiments were carried out to assess the degree of protection offered by sulfur in simple polymeric systems, either in aqueous solutions or liquids. Aqueous solutions (5 per cent) of polyvinylpyrrolidone and polyethyleneoxide were irradiated until gel formation occurred. Similar experiments were carried out with dimethylsiloxane polymer fluid. The dose to gel was found to be independent of dose-rate, but was greatly increased by the presence of extremely small amounts of colloidal sulfur (approximately $10^{-3} - 10^{-4}$ gram atoms per litre). The protective efficiency was sufficiently high to rule out combination with radicals as a reaction mechanism. Gas evolution was, however, unaffected in the silicones. No significant protection was observed in the presence of oxygen. (auth)

5924 ANTIRADIATION COMPOUNDS. I. ACYLATED DERIVATIVES OF β-MERCAPTOETHYLAMINE. William O. Foye, Ronald N. Duvall, and James Mickles (Massachusetts Coll. of Pharmacy, Boston). J. Pharm. Sci., 51: 168-73(Feb. 1962).

A series of S-acyl derivatives of β-mercaptoethylamine (MEA) was prepared in an attempt to provide compounds having protective effects in animal cells against ionizing radiation and having less toxicity than MEA itself. In general, toxicity to animals was reduced and good protective ability against x radiation was retained in some of the esters. The dithiocarbamic acid of MEA was also prepared, but attempts to acylate the compound, which showed good antiradiation effects at toxic dose levels in mice, gave only decomposition products. The S-acetyl derivative of MEA gave 60% protection over a 30-day survival period when mice were irradiated with 800 r. An 80% survival was observed after a dose of 575 r, nontoxic doses of the compound being injected 15 min prior to exposure. The S-octanoyl ester gave similar results. The S-myristoyl ester provided 65% protection against a dose of 575 r, but was ineffective against 800 r. The dithiocarbamic acid gave 75% protection against 800 r and 95% protection against 575 r, making this compound almost as effective as MEA itself. The benzoyl ester of MEA was not appreciably effective, affording only 10% protection from 800 r. The chloroacetyl ester gave no protection at all. It is possible that the compound underwent polymerization or cyclization before reaching the cells, when neutralized prior to injection. A lowering of toxicity resulted from ester formation. On the basis of the mixed disulfide hypothesis of radiation protection by mercaptans, the S-acyl derivatives of MEA would be expected to undergo hydrolysis in vivo, thus liberating MEA to form mixed disulfides with vital thio groups in the cells. However, rearrangement to the N-acyl derivatives was shown to occur readily at pH's above 7. (H.H.D.)

5925 SUBSTITUTIONAL THERAPY AT THE PEAK OF ACUTE RADIATION SICKNESS. A. N. Berkutov, L. S. Korchanov, N. A. Yaroslavtseva, and D. I. Bochagova. Med. Radiol., 7: No. 11, 59-65(Nov. 1962). (In Russian)

Investigations were made on the effectiveness of direct blood transfusions employed for substitutional purposes at the peak of acute radiation sickness. Experimental data obtained substantiate the opinion that direct blood transfusions help to replace the lost of impaired function of the bone marrow and peripheral blood and to augment the immunological protective mechanisms of the organism. (auth)

5926 THE TREATMENT OF ACUTE RADIATION SICKNESS BY MEANS OF HOMOTRANSPLANTATION OF FRESH AND PRESERVED SPLEEN. V. A. Revis. Med. Radiol., 7: No. 11, 65-73(Nov. 1962). (In Russian)

Subcutaneous homotransplantation of fresh donor spleen 24 hours after total x irradiation in a dose of 1100 r was performed in 50 rabbits. The spleen was preserved by 24-hr freezing at −75°C in glycerin media and preserving fluid, ensuring storage up to 45 days with good preservation of structure of splenic tissue. The radioprotective properties of the spleen are preserved during the storage, this being confirmed by the considerable increase in the number of survived animals and by the milder course of radiation sickness. (auth)

5927 THE EFFECT OF SOME PHARMACOPOEIAL PREPARATIONS ON EXPERIMENTAL RADIATION SICKNESS. A. V. Shubina. Med. Radiol., 7: No. 11, 83-5 (Nov. 1962). (In Russian)

The prophylactic effects of Aralio, Restharrow and leukogen were tested with 300 white rats weighing 150 to 170 g and irradiated with 700 r. It was found that the application of leukogen immediately after exposure followed by Aralio and Restharrow on the 6th day gave the best results. Results of combined and separate applications of pharmacological preparations at various intervals after exposure are discussed. (R.V.J.)

5928 THE BIOSYNTHESIS OF SERUM ALBUMIN IN RATS DURING RADIATION SICKNESS. O. G. Zamyatkina (Inst. of Biological and Medicinal Chemistry, Moscow). Radiobiologiya, 2: 685-9(1962). (In Russian)

An immunological chemical method developed by Khesin and Campbell was used to evaluate the synthesis of serum albumin in the liver of irradiated rats which had been given an x ray dose of 900 r. The rats were killed on the 4th to 11th day after irradiation, and 100 mg slices of liver were incubated for 3 hours at 38°C. The albumin concentration in the blood serum was unchanged 24 hours after the irradiation, but began to fall off on the third day after irradiation. In most cases, the synthesis of serum albumin is almost completely inhibited on the 6th day after irradiation,

and the initial amount of albumin in the liver slices was considerably decreased. The suppression of albumin synthesis is not a result of the direct action of ionizing radiation, but is accompanied by a general disruption in protein synthesis which is manifested on the 6th day after irradiation. The synthesis and total amount of albumin decrease in parallel. (TTT).

5929 A NUMBER OF FEATURES OF THE REGENERATION OF THE GASTROINTESTINAL TRACT DURING CHRONIC RADIATION SICKNESS INDUCED BY THE ADMINISTRATION OF POLONIUM AND OF RADIOACTIVE STRONTIUM. G. A. Lebedeva. Radiobiologiya, 2: 709-12 (1962). (In Russian)

A chronic radiation sickness was induced in 12 dogs and 128 rats by administering 0.02 μC of Po^{210} per gram subcutaneously and 0.003 to 0.005 μC of Po^{210} per gram intravenously, or 0.4 μC of Sr^{90} per gram intraperitoneally. The animals suffered a 40 to 45% loss in weight at the height of the radiation sickness. On autopsy, atrophy of the gastrointestinal tract, and degenerative changes of the parenchymatous organs were observed. Small beads of the mucous membrane covered with amorphous epithelium did not show any signs of secretion on being detected on the 182nd day after injection of Po^{210}. Differentiation of glandular cells in the mucous membrane in the lower part of a dog's stomach had been retarded, and an inactive epithelium had spread from the infected lesions to the basal sections of the glands. Nerve cells in the large intestine of the dog were shriveled up. Erosion of parts of the mucous membrane was noted. An analogous slow-down in recuperative processes was observed with the introduction of Sr^{90} only with the infliction of an added injury such as a burn or a cut. Operation on the stomach or intestines under conditions of chronic radiation sickness may result in post-operational complications due to the slow-down of recuperative processes in the gastrointestinal tract. (TTT).

5930 THE MECHANISM OF THE RADIOPROTECTIVE ACTION OF PYRIDOXINE AND OF ITS SULFUR DERIVATIVE 5-ISOTHIURONIUM PYRIDOXINE. A. F. Mosin (Inst. of Experimental Medicine, Leningrad). Radiobiologiya, 2: 763-7(1962). (In Russian)

The effect of pyridoxine and its S-derivative on the level of phospho-lipids and cholesterol in the blood of irradiated animals was investigated considering the concentration changes as an indicator of the injury to the molecular structure of the protoplasma albumin. The survival rate of mice exposed to LD_{50} and treated with pyridoxine was found in preliminary tests to be 38% higher than that of the control group; this figure dropped to 30% for the 5-isothiuronium derivative and to less than 20% for 3 other S derivatives. Post-irradiation tests were also carried out on male rabbits exposed to 17 r/min for an integral dose of 1000 r. Results showed that pyridoxine exerts a strong normalizing effect on the phospho-lipids and the cholesterol content of the blood serum while the 5-isothiuronium pyridoxine and mercamine do not exhibit such an effect. (TTT)

5931 DISTRIBUTION OF INDOL ALKYLAMINES EXHIBITING RADIOPROTECTIVE PROPERTIES IN THE ORGANS OF MICE. P. G. Zherebchenko. Radiobiologiya, 2: 780-4(1962). (In Russian)

The author et al. (Med. Radiobiologiya, 6: 8(1961)) have shown that oxy, methyl, and Cl substitutes in 5 positions of the indol ring of tryptamine yield radioprotective derivatives. In order to determine the importance of the distribution of these materials in the system in causing the radioprotective behavior, the concentration of the derivatives in the various organs of the mice has been determined after peritoneal injection. The following compounds were investigated: 5-methyl tryptamine and 5-methoxy tryptamine which are known to exert radioprotective action; the weakly active 6-methoxy tryptamine, and γ-3-indolyl propyl amine and δ-3-indolyl butylamine which are known to be inactive. The preparations were administered at a rate of 90 mg/kg body weight, decapitating animals 15, 30, 60, 120, and 180 minutes later and extracting the amines by a 1% HCl solution. Analysis of the liver, spleen, kidney, lung, brain, muscles, mucous membrane of the intestine, sperm ducts and plasma of the animals showed that the indolamines possessing radioprotective effect were distributed throughout the organism. Previous introduction of the inhibitor monoamine oxydase, α-methyl tryptamine changes the distribution of the 5-methyl tryptamine in the organs. Distribution of these materials in the sensitive organs appears to be responsible for their pharmacological effect and the biochemical reaction. (TTT)

5932 RADIOPROTECTIVE ACTION OF CYSTEAMINE IN THE CASE OF THE IRRADIATION OF ESCHERICHIA COLI IN THE PRESENCE OF RADIOSENSITIZERS SUCH AS ATMOSPHERIC OXYGEN AND NITROGEN OXIDE. E. A. Val'dshtein (Inst. of Cytology, Leningrad). Radiobiologiya, 2: 785-9(1962). (In Russian)

The radiation protective action of cysteamine and of other sulfhydryl compounds is attributed to the oxygen effect. This problem was further investigated by continuously passing air through a bacterial suspension of E. coli B/r and B; similar tests were made also with an O-free mixture of NO + N_2. The suspensions were exposed to a total dose of 22.50 kr at a rate of 1250 r/min. The cysteamine was determined by the iodometric method. Data on survival rates indicated that cysteamine exerts a protective action both in the presence and the absence of the sensitizers O_2 and NO; the protective property was independent of the formation of radiosensitizing agents. The effectiveness of the protection was more marked in the case of the E. coli B/r strain. (TTT)

5933 EFFECTS OF ROENTGEN IRRADIATION ON GLUCOSE AND FATTY ACID TRANSPORT IN SMALL INTESTINE OF RATS. Ingrid Wesemann, Bertram Kuss, Heinz Breuer, and Heinz-Karl Parchwitz (Chirurgischen Universitätsklinik und-Poliklinik, Bonn). Strahlentherapie, 119: 425-34(Nov. 1962). (In German)

In rats the transport of glucose, fatty acids, and water in everted small intestinal segments was investigated before and 22 and 44 hours after local irradiation of the small intestine with 1200 r. Twelve hours after irradiation the active transport of glucose and fatty acids was increased compared to the initial values; while the uptake of glucose and fatty acids was decreased. Fourty-four hours after irradiation the active transport as well as the uptake of glucose and fatty acids were diminished. The changes of the transport of water were similar to those of the substances mentioned. It was concluded that the effect of the irradiation on the active transport of glucose and fatty acids in the small intestine occurs without affecting the energy metabolism. (auth)

5934 CONCERNING THE INCREASE OF ABILITY OF RATS AFTER TOTAL-BODY IRRADIATION, TESTING IN SWIMMING EXPERIMENTS. Heribert Braun (Universitätsklinik, Würzburg, Ger.). Strahlentherapie, 119: 462-6(Nov. 1962). (In German)

Swimming experiments with inexperienced rats after total body irradiation with x rays are reported. Swimming-

times of the irradiated animals were longer in comparison with experiments done with non-irradiated rats. The interval between irradiation and the swimming test was important for the duration of the swimming-time. By transfusing blood of irradiated animals to non-irradiated animals a significant prolongation of the swimming-time could be observed in the non-irradiated animals. The problem of the mechanism of the effect is discussed briefly. (auth)

CHEMISTRY

General and Miscellaneous

Refer also to abstracts 6539 and 7550.

5935 (CEA-2204) CONTRIBUTION A L'ETUDE CHIMIQUE ET TECHNOLOGIQUE DE LA PRECIPITATION DE DIURANATE D'AMMONIUM. (Contribution to the Chemical and Technological Study of Ammonium Diuranate Precipitation). R. Vuillemey (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). 1962. 83p.

The present work is designed to study the relationship between the conditions for precipitation by ammonia and the properties of ammonium diuranate obtained either from uranyl nitrate solution or from gaseous uranium hexafluoride. In each case the optimum processes are defined leading on the one hand to uranate which can afterwards be treated in a reduction-fluorination oven to give uranium tetrafluoride, and on the other hand to a uranate suitable for the production of a sinterable uranium oxide. In particular it is shown that the treatment of uranyl nitrate solutions by stoichiometric quantities of ammonia leads to the complete precipitation of the uranium leaving less than 1 mg/litre of uranium in the solution, whereas the treatment of uranium hexafluoride necessitates the use of at least 8 times the stoichiometric quantity. (auth)

5936 (HW-SA-2815) ANALOG COMPUTER APPLICATIONS IN CHEMICAL ENGINEERING. R. A. Harvey and G. R. Taylor (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 25, 1962. Contract AT(45-1)-1350. 18p.

Four examples are described to demonstrate the applications of analog computers to chemical processes. They are: a chemical dissolver simulation in which transients were investigated, a chemical separations column problem in which it was desired to fit a mathematical model to experimental data, a calciner control problem, and a waste tank heat transfer design problem. (M.C.G.)

5937 (ORNL-TM-445) THE ORNL GAS SAMPLING EXPERIMENT IN CONNECTION WITH THE TAMALPAIS EVENT. W. E. Clark (Oak Ridge National Lab., Tenn.). Jan 7, 1963. Contract [W-7405-eng-26]. 6p.

Gas samples taken during the first 10 sec after detonation of the TAMALPAIS device indicated that not more than 3% of the tritium spike underwent exchange with hydrogen in the environmental water. The percentage of tritium in sequenced samples decreased rapidly with post-shot time. (auth)

5938 (TID-13249) A STUDY OF PYRENE DIMERS. Isadore B. Berlman (Argonne National Lab., Ill.). May 1961. Contract [W-31-109-eng-38]. 4p. (UAC-5243)

Results of studies concerning changes in the emission and in the fluorescence lifetime of pyrene in paraxylene and in cyclohexane for various concentrations of pyrene are reported. The measured decay times for several sample solutions are listed. (J.R.D.)

5939 (TID-13384) THE DETERMINATION OF THE EQUILIBRIUM WATER CONTENT OF ION EXCHANGE RESINS. George Scatchard and N. J. Anderson (Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry and Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). [Aug. 11, 1961]. Contract [AT(30-1)-905]. 14p.

The weights of two types of ion exchanger beads, Dowex 1-X8 and Dowex 50W-X8 are linear functions of the weights of glass beads in the range 425 to 3000 g centrifuged at the same time. The slopes are the same for solutions of HCl and NaCl as for water. The weights of the resin beads without retention of external water are obtained by extrapolation to the weight of dry glass beads. The volumes of water retained by unit volume of beads at any centrifugal force are in the ratios: glass 1, Dowex 1 (Cl) 0.88, Dowex 50 W (Na) 0.84, and Dowex 50 W (H) 0.74. The differences appear to be attributable to differences in the number of contracts per bead. (auth)

5940 (TID-15720) SCINTILLATING ION EXCHANGE RESIN. Progress Report No. 1. A. H. Heimbuch (Tracerlab. Div. of Lab. for Electronics, Inc., Richmond, Calif.). May 9, 1962. Contract AT(30-1)-2885. 14p.

Research was done to synthesize a scintillating, anion exchange resin that can be used for the analysis of radioactive, anionic species in aqueous solution. Plastic, scintillating beads made of cross-linked polyvinyltoluene containing p-terphenyl and POPOP as phosphors were used as the resinuous phase for the introduction of quaternary ammonium groups by chemical reactions. An exchange capacity of 0.03 milliequivalents per gram of beads was attained with 50% reduction in scintillation pulse height. Work continues toward improving both exchange capacity and scintillation pulse height. (auth)

5941 (TID-17239) PHYSICAL PROPERTIES AND STRUCTURAL CHARACTERISTICS OF POLYMERS RESULTING FROM "POST-EFFECT" POLYMERIZATION. Quarterly Technical Status Report No. 2, June 1, 1962 to August 31, 1962. L. W. Elston and W. H. Burrows (Georgia Inst. of Tech., Atlanta. Engineering Experiment Station). Sept. 10, 1962. Contract AT(38-1)-202. 13p.

Activities during the period included survey and review of literature pertinent to the various aspects of this project, studies of laboratory polymer characterization procedures using commercially available polymer samples, and modification of both equipment and experimental procedures. Calibration of equipment and preliminary experiments are nearly complete. Irradiation studies will be initiated during the next report period. (auth)

5942 (UCRL-9659) CLOSE-CAPTURE ABSORPTION SYSTEM FOR REMOTE RADIOISOTOPE CHEMISTRY. Neil C. Spencer, Thomas C. Parsons, and Patrick W. Howe (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 17, 1961. Contract W-7405-eng-48. 29p.

Molecular sieves are used as the basic adsorber in a close-capture air recirculation system designed primarily for remote operation with master-slave equipment. A compact evaporator-dissolver unit provides a vessel for dissolution of an Al slug containing the radioactive material and provides an evaporator head under which volume reduction may be carried out within a specially prepared centrifuge cone. One movable condenser serves both operations. Resistance films of Pt provide heat for the centrifuge cone and for a jet of air impinging on the surface of the liquid being evaporated. Moisture and acid vapors from the chemical operations are pumped from the main box and adsorbed on the molecular sieves in a separate enclosure. The dry air is then returned to the main box. Thus, by capturing vapors within a closed system and by continuously recirculating the box air through the absorb-

ers, a reasonably dry atmosphere is maintained at all times within the chemistry enclosure, and corrosive action is effectively reduced. (auth)

5943 THE USE OF LABELLED ATOMS IN THE DETERMINATION OF DIFFUSION COEFFICIENTS IN POLYMERS. B. A. Gromov, V. B. Miller, M. B. Neiman, and Yu. A. Shlyapnikov (Academy of Sciences, Moscow). Intern. J. Appl. Radiation Isotopes, 13: 281-5(June 1962). (In English)

The diffusion of antioxidants, 2:6-di-t-butyl-4-methylphenol (ionol) and phenothiazine in isotactic polypropene and polyformaldehyde was investigated. Measurements were made by means of C^{14}-labelled ionol and S^{35}-labelled phenothiazine, using the thick-layer method. The diffusion coefficients were found to be: for ionol in polypropene $D = 5 \times 10^6 \exp(-23000/RT)$ (over a temperature range of 60 to 110°C), for ionol in polyformaldehyde $D = 2.5 \times 10$ exp (–16300/RT) (80 to 110°C), for phenothiazine in polypropene $D = 1.0 \times 10^{12} \exp(-33400/RT)$ (80 to 105°C). (auth)

5944 SYNTHESIS OF A BORON-LABELED TETRABORANE. Riley Schaeffer and Fred N. Tebbe (Indiana Univ., Bloomington). J. Am. Chem. Soc., 84: 3974-5 (Oct. 20, 1962).

The synthesis of B^{10}-labeled tetraborane with most of the labeling in the 4 position is reported. The synthesis involved the preparation of sodium triborohydride-B^{10} and its reaction with isotopically normal diborane and hydrogen chloride. The B^{11} NMR spectra of the tetraborane is compared with that of a randomly labeled tetraborane, and a mechanism is proposed for the pyrolytic conversion of diborane to tetraborane. (D.L.C.)

5945 PREPARATION OF THIN TARGETS OF ISOTOPIC OXYGEN. R. Moreh (Israel Atomic Energy Commission, Rehovoth) and David Samuel. Rev. Sci. Instr., 33: 1292-3(Nov. 1962).

A method was devised for the preparation of self-supporting NiO targets by oxidation of Ni foils. The method comprises stripping the Cu backing from commercial Ni foils, mounting the foils on stainless steel strips, inserting several such mounts into a bell jar around a Pt loop, and oxidizing the foils by heating inside an induction heater with its coil coaxial with the Pt loop. The oxidation occurs by radiation heating from the glowing loop in highly enriched O_2 at 10 to 20 mm Hg pressure. Ni foils with thicknesses of 750, 1000, and 1250 A were oxidized uniformly with the method. Aluminum oxide films were also prepared in a similar way. (D.L.C.)

Analytical Procedures

Refer also to abstract 7306.

5946 (AERE-AM-91) THE DETERMINATION OF IRON IN ZIRCONIUM AND ITS ALLOYS. C. F. Bush (United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation; Kent, England). Nov. 1962. 4p.

Zr metal or alloy is dissolved in HF, and the latter removed by boiling with sulfuric acid. The Fe is determined absorptiometrically on a sample aliquot containing not more than 0.25 g of Zr, using thioglycollic acid in an ammoniacal citrate solution. (auth)

5947 (AFCRL-62-295) TRITIUM DETERMINATIONS IN ATMOSPHERIC GASES AND METEORITES. Summary Report No. 1, November 1, 1960–October 31, 1961. F. Begemann (Max-Planck-Institut für Chemie, Mainz). Contract AF61(052)-465. 13p.

Methods are outlined for determining tritium in atmospheric hydrogen and methane. Results are listed for several samples. A vacuum system was set up for the extraction of rare gases from meteorites. (R.J.S.)

5948 (AWRE-0-62/62) DETERMINATION OF MICROGRAM AMOUNTS OF CARBON IN SODIUM. J. Herrington (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Nov. 1962. 17p.

A method of determining C present in Na as carbonate or elemental C in amounts equivalent to 5-25 μg C is described. The method involves combustion to the oxides and carbon dioxide. (R.J.S.)

5949 (BNL-5814) DETERMINATION OF CARBON–HYDROGEN RATIOS BY NEUTRON SCATTERING. H. L. Finston and E. Yellin (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT(30-2)-Gen-16]. 18p.

A series of organic compounds, including hydrocarbons, alcohols, ketones, and esters were analyzed for hydrogen by a thermal neutron scattering technique. The neutron transmission was found to vary smoothly with the hydrogen content over the range investigated (8 to 10% hydrogen) indicating that the thermal neutron cross section per hydrogen atom is constant for all these compounds. The lower limit of sensitivity for determination of hydrogen content was found to be approximately 0.1% hydrogen by weight. The neutron source consisted of a Pu-Be mixture emitting 8.2×10^6 n/sec which were thermalized by D_2O. A collimated beam was directed at an A_1 cell containing the sample, and the transmitted neutrons measured with a BF_3 counter. (auth)

5950 (GAT-471) AN IMPROVED TITRIMETRIC METHOD FOR THE PRECISE DETERMINATION OF URANIUM. O. A. Vita, C. F. Trivisonno, and C. R. Walker (Goodyear Atomic Corp., Piketon, Ohio). Nov. 23, 1962. Contract AT(33-2)-1. 10p.

A precise potentiometric titration method used for determining U has been re-evaluated and improved. The improvement eliminates the slow, tedious dichromate titration of the uranium(IV)–uranium(VI) end point, and replaces it with a rapid colorimetric determination of a slight excess of oxidant. This innovation decreases the time required for an analysis by 30 min, minimizes the number of determinations that yield no useful result, and makes the procedure more adaptable to the handling of a larger number of samples simultaneously. All this is accomplished with no significant change in the precision, which remains at 0.015% per determination. (auth)

5951 (HW-74796) MEASUREMENTS ON PHOENIX FUEL STANDARDS. T. B. Thornbury (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 10, 1962. Contract [AT(45-1)-1350]. 9p.

The boron and plutonium contents of the poison standards for the Phoenix Fuel experiment were measured in the Physical Constants Testing Reactor (PCTR). This demonstrated the use of the PCTR to measure the quantity of fissile material in a sample by varying the relative worths of the fast and thermal neutrons. The worth of thermal neutrons, at the sample position, was reduced more than the worth of fast neutrons by surrounding the sample with a 1-in. water jacket to which 0.001 g/cc boron was added. (auth)

5952 (IA-772) SEPARATION OF PRECIPITATES OF LABELLED ELEMENTS USING ADHESION ON GLASS. J. Yofé, R. Rafaeloff, and W. Tuler-Magnuszewski (Israel. Atomic Energy Commission, Rehovoth). Sept. 1962. 12p.

Various ions were determined by precipitation of labeled materials on a watch glass, followed by drying and washing

to constant count rates. As little as 0.1 μg of I^- and Ag^+, 2 μg of Ca^{2+}, 4.5 μg of Sr^{2+}, 7 μg of Ba^{+2}, 5 μg of SO_4^{2-}, 0.7 μg of Bi^{3+}, 0.2 μg of Zr^{4+}, 6 μg of Th^{4+}, and 0.3 μg of PO_4^{-3} could be determined. (auth)

5953 (IEA-48) DETERMINACAO DE CÁDMIO EM URÂNIO: BISMUTIOL COMO AGENTE PRECIPITANTE. (Determination of Cadmium in Uranium: Bismutiol as Precipitating Agent). Alcídio Abrão (Brazil. Instituto de Energia Atomica, São Paulo). May 1962. 11p.

The precipitation of cadmium with bismutiol in solutions of uranyl nitrate or sulfate, in the region of several mg of Cd, was studied. The method can be used as a substitute for precipitation with H_2S or thioacetamide or for electrodeposition of cadmium at the mercury cathode. (tr-auth)

5954 (IS-431) vic-DIOXIMES AS ANALYTICAL REAGENTS. Charles V. Banks (Ames Lab., Ames, Iowa). [Mar. 6, 1962]. Contract [W-7405-eng-82]. 37p.

A review of research that has contributed to a better understanding of the solubility relations among vic-dioximes is presented. Included are sections on synthesis, analysis, structure, and analytical uses of these complexes. (J.R.D.)

5955 (JÜL-74-PC) SPEKTROPHOTOMETRISCHE UNTERSUCHUNGEN ZUM SYNERGISTISCHEN SYSTEM URANYL–ION/Di-2-ATHYLHEXYLPHOSPHORSAURE/Tri-N-OKTYLPHOSPHINOXYD. (Spectrophotometric Studies of the Synergistic System Uranyl Ion–Di-2-Ethylhexyl Phosphoric Acid–Tri-N-Octylphosphine Oxide). H. Ihle, H. Michael and A. Murrenhoff (Kernforschungsanlage. Institut für Physikalische Chemie, Jülich, Germany). Oct. 1962. 23p.

For the system uranyl-ion–tri(n-octyl)phosphine oxide (TOPO)–excess di (2-ethylhexyl)phosphoric acid (D2EHPA) in kerosene the ratio U:TOPO of the complex formed was investigated spectrophotometrically using the method of continuous variations. In solutions 0.1M in D2EHPA and 10^{-2} to 10^{-3}M in hexavalent uranium and TOPO, a complex with the molar ratio U:TOPO = 1:1 was identified. The order of magnitude of the dissociation constant of this complex was found to be 10^{-4}. The applicability of the method of continuous variations to the investigation of this system complicated by side reactions was demonstrated theoretically. The calculations refer to the following types of reactions: $AC_2 + nB = AC_2B_n$ and $AC_2 + nB = AC_{(2-n/2)}B_n + n/2C$ considering the side reactions $B + C = BC$ and $B + \frac{1}{2} C = BC_{\frac{1}{2}}$. (auth)

5956 (KR-30) MASS SPECTROMETRIC DETERMINATIONS OF ^{17}O AND ^{18}O IN HEAVY WATER OF VARIOUS ORIGINS. John Haaland and Dick Stijfhoorn (Norway. Institutt for Atomenergi, Kjeller). Oct. 1962. 10p.

Heavy water samples from Savannah River (USA) and the Norsk Hydro factory in Norway were compared with respect to the O^{17} and O^{18} content. The samples were electrolyzed and the oxygen gas analyzed in a CH_4 mass spectrometer. The Savannah River samples showed an O^{18} enrichment of about 82% of normal content as compared with 15% for the Norsk Hydro samples. (auth)

5957 (PG-Report-294) ANALYTICAL METHOD FOR THE DETERMINATION OF COPPER IN URANYL NITRATE SOLUTIONS, AMMONIUM DIURANATE, URANIUM OXIDES, URANIUM TETRAFLUORIDE AND URANIUM METAL. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 7p.

The Cu-containing solution is treated with Na citrate solution to complex U. Hydroxylamine hydrochloride and alcoholic neo-cuproine are added and the resulting cuprous complex is extracted into chloroform and measured absorptiometrically. The method is applicable to samples containing 5 to 480 μg Cu. A long-term precision test under routine conditions and involving several operators gave a standard deviation of 6.6 ppm at the 200 ppm Cu level in uranium trioxide. (auth)

5958 (PG-Report-306) ANALYTICAL METHOD FOR THE DETERMINATION OF THE β-ACTIVITY DUE TO TANTALUM-182 IN A TANTALUM DISC NEUTRON DOSIMETER. J. C. Dalton (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 7p.

The β-activity, due to Ta^{182} in the Ta disc neutron dosimeter, is measured using standard Geiger-Müller thin end-window counting equipment through a total absorber thickness of 3 mg/cm^2. (auth)

5959 (PG-Report-329) ANALYTICAL METHOD FOR THE RAPID VISUAL DETERMINATION OF FLUORINE IN THE ATMOSPHERE. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 8p.

A sample of air is drawn through a high speed bubbler and the time taken by F_2 to decolorize a given volume of standard methyl red solution is measured. (auth)

5960 (PG-Report-337) THE DETERMINATION OF ANTIMONY AND COBALT IN MAGNESIUM-BASE ALLOYS BY NEUTRON ACTIVATION ANALYSIS. R. Todd, G. Cuthbert, and R. Dickinson (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 38p.

A method is described for the determination of Sb and Co in Mg alloyed with small amounts of Al or Mn. The method involves remote irradiation in a nuclear reactor, radiochemical separation of the resulting Sb and Co activities, and comparison of these activities with those isolated from standards irradiated at the same time. The separation procedures are intended to be virtually specific, but not unreasonably time-consuming. It is shown that a hydrochloric acid/hydrogen-peroxide dissolution leads to no losses of Sb as stibine, or of either element in the form of insolubles. It is also shown that chemical exchange between antimonyl tartrate and Sb present in chloride or sulfate solution is slow, and the antimonyl tartrate standards must be fumed to destroy tartrate. Results for Sb and Co were obtained at levels down to 0.05 and 0.01 ppm, respectively, both being appreciably above the limit of detection. (auth)

5961 (PG-Report-340) ANALYTICAL METHOD FOR THE DETERMINATION OF THE PLUTONIUM/URANIUM RATIO ON THE FEED SOLUTION OF THE WINDSCALE PRIMARY SEPARATION PLANT (ISOTOPE DILUTION METHOD). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 23p.

The method comprises the determination of U and Pu concentrations by the isotope dilution technique, after addition of known amounts of uranium-233 and plutonium-242 tracers to a diluted sample of the feed solution, using a mass spectrometer. (auth)

5962 (PG-Report-345) ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF IRON AT LOW LEVELS IN URANIUM METAL (USING 1:10 PHENANTHROLINE). (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 7p.

Uranium in HCl solution is complexed with ammonium tartrate. Iron is determined absorptiometrically following the extraction of the ferrous 1,10-phenanthroline-iodide complex into chloroform. (auth)

5963 (PG-Report-350) ANALYTICAL METHOD FOR THE DETERMINATION OF WATER IN POWDERED METALS AND COMPOUNDS BY VACUUM DISTILLATION. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 5p.

Water is distilled from the sample at 100°C in vacuo and collected in a cold trap at −183°C. The water is expanded in a calibrated volume at room temperature and measured at low pressure using an oil manometer. The method is applicable to powdered metals such as Be, Fe, Ni, Nb, U, and V, and to powdered compounds such as SiC and UO_2, which do not react with water at room temperature. The extent to which combined water will be determined is dependent upon the particular material/water system in question. The method determines the water released from the sample, in vacuo, during a period of 15 minutes at 100°C. The lower limit of detection of the method is 50 μg water and a precision of ±20% (2 × sigma) is estimated for a 1 g sample at the 500 ppm level. (auth)

5964 (PG-Report-356) ANALYTICAL METHOD FOR THE DETERMINATION OF ^{210}Po AND ^{230}Th IN URANIUM ORE CONCENTRATES AND PLANT LIQUORS. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 12p.

Polonium-210 is precipitated with Cu as the sulfide. The precipitate is separated and α activity due to Polonium-210 is evaluated using an α scintillation counter. Thorium-230, present in the filtrate, is precipitated with La as fluoride. The precipitate is separated and α activity due to thorium-230 is also evaluated using an α scintillation counter. The method can be applied to any U ore concentrate, or uranic liquor derived from natural sources. It is inadvisable to apply the method to irradiated materials because of the possible presence of interfering isotopes. (auth)

5965 (PG-Report-362) ANALYTICAL METHOD FOR THE DIRECT ABSORPTIOMETRIC DETERMINATION OF BORON IN ZIRCONIUM METAL AND ITS ALLOYS. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 8p.

The sample is dissolved in a mixture of ammonium sulfate and sulfuric acid. Rosocyanin is formed in the presence of Zr and, after separation from excess curcumin, it is dissolved in ethanol for absorptiometric measurement. (auth)

5966 (PG-Report-364) ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF SULPHUR IN URANIUM METAL AND ITS COMPOUNDS. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 7p.

Supersedes SCS-M-264.

After treatment of the sample with aqua regia, followed by decomposition of any nitrate in the solution, sulfur, reduced to hydrogen sulfide and separated by distillation into zinc acetate solution, is determined absorptiometrically as methylene blue. (auth)

5967 (PG-Report-381) ANALYTICAL METHOD FOR THE DETERMINATION OF HYDROGEN, OXYGEN AND NITROGEN IN METALS AND COMPOUNDS BY THE MICRO-PLATINUM BATH VACUUM FUSION METHOD. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 16p.

A small sample of the metal or compound is reacted, in vacuo, in a degassed bath of molten Pt contained by a small graphite crucible heated to 1900°C by radio frequency heating. Hydrogen, carbon monoxide, and nitrogen evolved during the reaction are pumped away and measured and analyzed by a low-pressure gas analytical system. After deducting an apparatus blank, the H, O, and N contents of the sample are calculated. (auth)

5968 (PG-Report-385) ANALYTICAL METHOD FOR THE DETERMINATION OF SODIUM-24 IN BLOOD BY GAMMA SPECTROMETRY. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 9p.

Sodium-24, formed by neutron irradiation of sodium-23 present naturally in human blood, is estimated by a γ-spectrometric method. The identity of the activity may be confirmed by observing its rate of decay and comparing this with the known half life of sodium-24, which is 15.0 hr. (auth)

5969 (PG-Report-387) ANALYTICAL METHOD FOR THE DETERMINATION OF THE BETA ACTIVITY DUE TO PHOSPHORUS-32 IN A SULPHUR DISC NEUTRON DOSIMETER. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 9p.

The β-activity of the S disc component of a radiation dosimeter locket is measured directly using standard Geiger-Müller thin end-window counting equipment. The disc is then ignited and the β-activity of the residue is similarly determined. Subsequent measurements are made in order to serve as a guide to the radiochemical purity of this activity. (auth)

5970 (PG-Report-391) THE DETERMINATION OF TRACES OF BORON IN ZIRCONIUM METAL AND ZIRCONIUM ALLOYS. M. R. Hayes and J. Metcalfe (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 9p.

A general procedure is given for the determination of B, down to 0.2 ppm, in Zr and Zr alloys. Separation of the B is not necessary, the B-curcumin complex being formed directly in an aliquot of the metal sulfate solution. An interference effect has been noted when analyzing Zr alloys containing Sn. The interference is caused by an insoluble compound of curcumin which separates and has similar properties to the B-curcumin complex. This source of interference is, however, readily eliminated during the procedure for the determination of B. The procedure has been applied to the determination of B in pure Zr, Zr−0.5% Cu−0.5% MO, and Zr−1.5% Sn−0.1% Fe−0.1% Cr−0.05% Ni alloys. Results are comparable with those obtained by methods requiring the separation of the B as methyl borate. (auth)

5971 (PG-Report-402) ANALYTICAL METHOD FOR THE DETERMINATION OF DIBUTYL PHOSPHORIC ACID IN TRIBUTYL PHOSPHATE KEROSENE MIXTURES (INFRA-RED SPECTROMETRY). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 6p.

Dibutyl phosphoric acid (dibutyl hydrogen phosphate) is extracted into dilute sodium hydroxide solution. The free acid is liberated by acidifying the aqueous extract and extracted into carbon tetrachloride. The absorption at 1036 cm^{-1}, ascribed to the P-O-C linkage, is measured. (auth)

5972 (PG-Report-403) ANALYTICAL METHOD FOR THE DETERMINATION OF GROSS BETA ACTIVITY IN VEGETATION, SEAWEED, FISH FLESH, SHORE SAND, SILT AND SEABED MUD BY THE 'INFINITE DEPTH' TECHNIQUE. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 8p.

Samples of vegetation, seaweed, and fish flesh are ashed and those of shore sand, silt, and seabed mud are

dried. The activity of the sample is measured by a thin end-window Geiger-Müller tube which has been calibrated against a natural potassium chloride standard. The activity of the sample is expressed as equivalent $\mu\mu c$ (K^{40}) per gram. (auth)

5973 (PG-Report-406) ANALYTICAL METHOD FOR THE DETERMINATION OF N-BUTANOL IN MIXTURES OF TRIBUTYL PHOSPHATE AND KEROSENE (INFRA-RED ABSORPTION SPECTROMETRY). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 6p.

The sample is treated with nitrous acid to convert the 1-butanol to butyl nitrite. The optical density is measured at 1655 cm^{-1}, the absorption at this wave length being ascribed to the N-O linkage. The method may be used for specification tests on tributyl phosphate or for inspecting TBP/OK feed solutions, and is based on standard chemical and infrared techniques. (R.J.S.)

5974 (PG-Report-407) ANALYTICAL METHOD FOR THE DETERMINATION OF SMALL AMOUNTS OF TRIBUTYL PHOSPHATE IN AQUEOUS RAFFINATES (INFRA-RED ABSORPTION SPECTROMETRY). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 5p.

Tributyl phosphate is extracted from the aqueous sample into carbon tetrachloride. The optical density of the extract at an absorption peak at 1029 cm^{-1}, ascribed to the P-O-C linkage, is measured. The method is intended for the determination of tributyl phosphate in any aqueous raffinate, and is based on standard chemical and infrared procedures. (auth)

5975 (PG-Report-414) ANALYTICAL METHOD FOR THE DETERMINATION OF SMALL AMOUNTS OF BUTEX IN MIXTURES OF TRIBUTYL PHOSPHATE AND KEROSENE (INFRA-RED ABSORPTION SPECTROMETRY). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 6p.

The sample is washed with a solution of sodium carbonate and examined with an infrared spectrometer. The absorption of radiation at 1118 cm^{-1}, which is ascribed to the C-O-C linkage, is measured and from this the concentration of butex obtained. The method is designed primarily for the determination of butex in mixtures of tributyl phosphate and kerosene which are used in the Uranium Purification Plant, and is based on standard chemical and infrared techniques. (auth)

5976 (TID-14592) PREVENTION OF SPATTERING DURING HIGH TEMPERATURE IGNITIONS. Norman A. Frigerio (Argonne National Lab., Ill.). Oct. 1961. Contract [W-31-109-eng-38]. 2p. (UAC-5717)

The determination of many lanthanide and actinide compounds can be accomplished by furnace ignition at 650 to 1100°; however, spattering may occur resulting in low analysis values. Spattering can be prevented by insertion of a quartz wool plug in the ignition crucible immediately above the sample. The plugs are stable and can be cleaned with aqua regia. (J.R.D.)

5977 (TID-15070) PRECISE AUTOMATIC COLORIMETRY ANALYSIS IN THE LOW PARTS PER BILLION RANGE. R. D. Britt, Jr. (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [Feb. 1962]. Contract AT(07-2)-1. 22p.

The sensitivity and precision of colorimetric methods were improved by means of automatic instrumentation. Quantitative colorimetric analyses are automated for the determination in water of chloride, nitrate, nitrite, ferrous, ferric, and ammonium ions with a sensitivity of a few parts per billion. The precision of these methods was 2 to 3% at a concentration of 10 ppb. The automated methods are rapid and applicable to continuous in-line analysis and batch analysis. (auth)

5978 (TID-15319) COLORIMETRIC DETERMINATION OF IRON IN URANIUM–FISSION ELEMENT ALLOYS. J. J. McCown and D. E. Kudera (Argonne National Lab., Idaho Falls, Idaho). Jan. 1962. Contract W-31-109-eng-38. 4p. (UAC-5934)

A simplified procedure is reported for the colorimetric determination of less than 0.01% Fe in U alloys containing Mo, Ru, Pd, Rh, and Zr. A study was made of the absorption spectra of the complex used, the effect of the hexone added, the time required for full color development, and the stability of the colored complex in the organic medium. (R.J.S.)

5979 (TID-15359) AN IMPROVED PROCEDURE FOR THE DETERMINATION OF U^{235} IN IMPURE URANIUM MATERIALS USING NEUTRON ACTIVATION TECHNIQUES. W. D. Kelley and B. L. Twitty (National Lead Co. of Ohio, Cincinnati). [1958]. Contract [AT(30-1)-1156]. 8p.

An improved neutron activation procedure for determining the U^{235} content in impure U samples is presented. A relative precision of ±1% is obtained at the level of 0.7 wt% U^{235}. An ethyl acetate extraction is used to purify the U chemically. Most of the U decay products are removed by extraction with 2-thenoyltrifluoroacetone (TTA) in xylene. The purified U, which is subsequently activated as U_3O_8, has a consistent gamma background level. Utilization of a 1-7/8-in.-ID well scintillation crystal has permitted the use of large diameter Al planchettes holding 2 g aliquots of U_3O_8. This system has minimized the problem of varying irradiation geometries caused by differences in U_3O_8 bulk density. Data from a sample recycle program are presented to illustrate the relative precision of ±1%. Comparisons between neutron activation and mass spectrometric results agree within ±1%. (auth)

5980 (TID-15512) NEW TECHNIQUES IN RADIOGRAPHY. Norman S. Beyer (Argonne National Lab., Ill.). Feb. 1962. Contract [W-31-109-eng-38]. 21p. (UAC-6043)

Development of techniques in radiography is reported. Topics covered include techniques for the radiography of thin aluminum, radiography with a scattered beam, the use of Polaroid 3000 speed film packets, and the production of colored radiographs. (M.C.G.)

5981 (VDIT-66) THE DETERMINATION OF RADIOACTIVE ISOTOPES IN URINE. A Bibliography. W. Uhlmann (Aktiebolaget Atomenergi, Stockholm). Nov. 1962. 64p.

This bibliography contains 164 abstracts arranged in chronological order. Material up to October 1962 was covered. Alphabetical indexes of radioisotopes, authors, report numbers, and journals and periodicals have been attached. (R.J.S.)

5982 (CEA-tr-X-461) ANALYSE SPECTROSCOPIQUE DES RAYONS X FLUORESCENTS OBTENUS PAR L'EMPLOI D'UNE SOURCE β. (X-Ray Fluorescence Spectroscopic Analysis Obtained Using a β Source). S. Enomoto and C. Mori. Translated into French by S. S. Minn from Oyo Butsuri, 30: 569-77(1961). 33p. (Includes original, 8p.).

The possibility of using fluorescent x rays produced by β particles for the analysis of binary samples is examined. The principle of the method is that the β particles scattered by the sample are deflected by a magnet placed in

front of the counters. The x rays characteristic of the crystal elements are discriminated by a filter or pulse-height analyzer. The technique was tested by an analysis of Cu–Zn and Cu–Sn alloys and by the measurement of the thickness of a Cr or Cd layer on Cu plates. The theoretical calibration curve is compared with the experimental one. It was determined that the factor determining the shape of the calibration curve is principally the absorption characteristics of the sample itself with respect to the x rays produced. (J.S.R.)

5983 IDENTIFICATION OF A PREVIOUSLY UNASSIGNED 5-SECOND BROMINE ACTIVITY AND ITS USE IN NEUTRON ACTIVATION ANALYSIS. Oswald U. Anders (Dow Chemical Co., Midland, Mich.). Anal. Chem., 34: 1678-80(Dec. 1962).

A previously observed short-lived activity produced by the irradiation of bromine with neutrons was measured to decay with a half life of 5.08 ± 0.07 seconds and could be definitely assigned to a metastable state of Br^{79}. The possible use of this activity for the determination of bromine by neutron activation analysis of samples is demonstrated. The sensitivity found for activation with a ≤6-Mev neutron flux of $\sim 1 \times 10^8$ n/cm^2/sec was ~50 ppm for 10-gram samples. The usefulness of the activity was compared to bromine determinations employing other neutron activation products. (auth)

5984 NEUTRON ACTIVATION ANALYSIS OF ALLOY STEEL AND ELECTRO-ETCH RESIDUES FOR SIXTEEN ELEMENTS. I. J. Gruverman and W. A. Henninger (Nuclear Science and Engineering Corp., Pittsburgh). Anal. Chem., 34: 1680-3(Dec. 1962).

A nickel-base high-alloy steel sample and residues from electro-etching procedures on similar steel samples were analyzed. Activation analysis techniques were used to determine the concentration of 16 elements—Sb, Bi, Ca, Cr, Co, Pb, Mn, Mo, Ni, P, Ag, S, Sn, Ti, U, and Zr. (auth)

5985 ANION EXCHANGE SEPARATION AND SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF RHODIUM IN PLUTONIUM–URANIUM–FISSIUM ALLOYS. Harold B. Evans, Carol A. A. Bloomquist, and John P. Hughes (Argonne National Lab., Ill.). Anal. Chem., 34: 1692-5(Dec. 1962). (TID-16207)

Microgram amounts of rhodium were separated from the components of an EBR II fuel alloy, using Dowex 1 × 10 anion exchange resin. Uranium, plutonium, palladium, molybdenum, and a portion of the zirconium and ruthenium remained on the column, while rhodium, americium, and the remaining zirconium and ruthenium were found in the eluate. Ruthenium was removed by fuming with $HClO_4$. The rhodium was determined spectrophotometrically as the red chloro complex, formed in the presence of hydrochloric acid and tin(II) chloride. The molar absorptivity of the colored species was approximately 4200. (auth)

5986 FRACTIONAL PRECIPITATION OF LANTHANUM–PRASEODYMIUM IODATE FROM HOMOGENEOUS SOLUTION USING DOUBLE COMPLEXATION AND REPLACEMENT. F. H. Firsching (Univ. of Georgia, Athens). Anal. Chem., 34: 1696-8(Dec. 1962).

An efficient separation of lanthanum from praseodymium is described. Equal amounts of lanthanum and praseodymium were complexed by equivalent amounts of [(carboxymethylimino)bis-(ethylenenitrilo)]tetraacetic acid and N-(carboxymethyl)-N′-2-hydroxyethyl-N,N′-ethylenediglycine, and iodate was added. A dilute solution of cadmium chloride was added dropwise to the stirred solution, selectively releasing lanthanum from its complex. A precipitation of rare earth iodate, enriched in lanthanum, occurred and continued as cadmium was added. The final precipitate contained about 99% of the lanthanum and 30% of the praseodymium. The filtrate contained about 70% of the praseodymium and 1% of the lanthanum. (auth)

5987 TEFLON DROPPING MERCURY ELECTRODE FOR POLAROGRAPHY IN HYDROFLUORIC ACID AND OTHER GLASS-CORRODING MEDIA. Helen P. Raaen (Oak Ridge National Lab., Tenn.). Anal. Chem., 34: 1714-23 (Dec. 1962).

A Teflon D.M.E. satisfactory for polarography in glass-corroding media was developed for the first time. It is dimensionally stable and has a round smooth-walled orifice that can be made to within ±10 microns of a specified diameter, a lapped face, and a bore of shape that can be varied. Teflon D.M.E.s of orifice diameter in the range from 15 to 110 microns were made. Satisfactory geometric and performance characteristics were proved by means of photomicrography and high-speed motion-picture photography and by determining: the nature of drop formation; values of m, t, and w; electrocapillary curves; current-voltage recordings; polarographic reduction waves; and a diffusion current vs concentration curve. Data were taken for glass-corroding solutions of hydrofluoric acid and sodium hydroxide. Reference data were taken for a glass D.M.E. in several media that do not corrode glass. The Teflon D.M.E. behaves essentially the same as a glass D.M.E. The few differences in behavior favor use of the Teflon D.M.E. It appears that certain data taken with glass and Teflon D.M.E.s can be intercompared. (auth)

5988 SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM AMOUNTS OF CERIUM WITH 2-METHYL-8-QUINOLINOL. Seizo Misumi and Norimitsu Nagano (Kyushu Univ., Fukuoka). Anal. Chem., 34: 1723-6(Dec. 1962).

A spectrophotometric method for the determination of micro amounts of cerium with 2-methyl-8-quinolinol is described. Cerium forms a complex with 2-methyl-8-quinolinol at a pH of about 10 when malic acid is used as an auxiliary chelating agent. The colored cerium(IV) complex, $Ce\text{-}(C_{10}H_8NO)_4$, is completely soluble and remarkably stable in carbon tetrachloride. The carbon tetrachloride extract containing the complex has a maximum absorbance at 485 mμ, and Beer's law is followed with good precision up to 0.5 μg of Ce per ml. Iron(II, III), thorium(IV), the rare earths(III), fluoride, and phosphate ions interfere. (auth)

5989 RUBIDIUM DETERMINATION IN RUBIDIUM-DOPED, THALLIATED, SODIUM IODIDE SCINTILLATION CRYSTAL USING SODIUM TETRAPHENYLBORON. Kenneth J. Jensen (Argonne National Lab., Ill.). Anal. Chem., 34: 1740-7(Dec. 1962).

To determine milligram amounts of rubidium in sections of a rubidium-doped, thalliated, sodium iodide scintillation crystal, rubidium was precipitated and estimated as rubidium tetraphenylboron after prior separation of thallium on an anion exchange column. Potassium contamination seriously affected the determination. A flame photometric method was used to estimate potassium included in the rubidium tetraphenylboron precipitate. This permitted a correction to be made, which allowed a distinction between potassium originally present in the crystal and small amounts of potassium spuriously introduced during the analysis. Techniques used to estimate, eliminate, or set a limit on possible errors in the determination due to cesium and ammonium ions and to large amounts of sodium chloride are given. (auth)

5990 POLAROGRAPHIC DETERMINATION OF URANIUM(IV) IN SODIUM TRIPOLYPHOSPHATE SUPPORTING

ELECTROLYTE. H. E. Zittel and Louise B. Dunlap (Oak Ridge National Lab., Tenn.). Anal. Chem., 34: 1757-60 (Dec. 1962).

The anodic behavior of U(IV) at the D.M.E. in a sodium tripolyphosphate-sodium sulfate medium as studied. In this medium, U(IV) exhibits an anodic wave whose $E_{\frac{1}{4}}$ is −0.19 volt vs S.C.E. and whose i_d is proportional to the U(IV) concentration. The proper conditions for analytical use of the anodic wave were established, and the effects of pH and uranium concentration were studied. The best results were obtained in a 6 w/v % $Na_5P_3O_{10}$ − 0.1 M Na_2SO_4 medium of pH 9. The error of the U(IV) determination was about ±3%. The U(VI) content of a sample may also be determined by measurement of the U(VI) cathodic wave at −1.1 volts vs S.C.E. in the medium. Possible interferences by various cations and anions were studied. Of the ions studied, only Fe(II) interfered to any extent. (auth)

5991 A COMPLETE SEPARATION OF A MIXTURE OF ZIRCONIUM(IV), COPPER(II), MOLYBDENUM(VI), TITANIUM(IV), VANADIUM(IV), AND MAGNESIUM(II) BY ION EXCHANGE CHROMATOGRAPHY. Carl Michaelis, Sylvester Eveslage, Paul Coulter, and John Fortman (Univ. of Dayton, Ohio). Anal. Chem., 34: 1764-6(Dec. 1962).

A detailed method of separation of a mixture of Zr(IV), Cu(II), Mo(VI), Ti(IV), V(IV), and Mg(II) on Dowex cation and anion exchange resins using hydrochloric acid elution is reported. The titanium, vanadium, and magnesium were not retained by the anion exchange resin, but the zirconium, copper, and molybdenum, which form the anionic chloro complexes, were. After the titanium, vanadium, and magnesium were washed from the anion exchange column with 9M hydrochloric acid, the mixture was made 11M in acid and passed through the same column. The titanium was retained while the other two passed through. The vanadium and magnesium were then separated on the cation exchange column. The zirconium, copper, and molybdenum were successively eluted from the anion exchange column by selecting the proper concentration of eluting acid. Elution curves were prepared for zirconium, copper, molybdenum, magnesium, and vanadium. (auth)

5992 RADIOMETRIC ANALYSIS OF METALS USING CHELATES LABELED WITH CARBON-14 AND LIQUID SCINTILLATION COUNTING PROCEDURES. Jorge Chiriboga (UT-AEC Agricultural Research Lab., Oak Ridge, Tenn.). Anal. Chem., 34: 1843(Dec. 1962).

A method is described for the determination of calcium or other alkaline earth metals using oxalic acid labeled with C^{14}. The results demonstrate a linear relation between the quantity of calcium present and the cpm of C^{14} oxalate. (P.C.H.)

5993 DETERMINATION OF THE TOTAL OXYGEN CONTENT OF ORGANIC MATERIALS BY FAST NEUTRON ACTIVATION. R. A. Stallwood, W. E. Mott, and D. T. Fanale (Gulf Research and Development Co., Pittsburgh). Anal. Chem., 35: 6-10(Jan. 1963).

A rapid nondestructive method for the determination of oxygen in organic materials, which requires no chemical processing and is relatively free of interference, is based on the irradiation of approximately 6 grams of sample in a 14-Mev neutron flux of $\sim 10^8$ neutrons per cm^2 per second, and the scintillation counting of the radiation from the 7.4-second N^{16} produced by the $O^{16}(n,p)N^{16}$ reaction. Oxygen concentrations greater than 100 ppm can be routinely measured to within 10% in less than 10 minutes by the method; at 30 ppm the relative standard deviation on a result is estimated to be about 25%. (auth)

5994 DETERMINATION OF PHOSPHORUS IN HYPEREUTECTIC ALUMINUM−SILICON ALLOYS BY A NEUTRON ACTIVATION METHOD. Robert Blackburn and Brian F. G. Peters (Tube Investments Research Labs., Cambridge, Eng.). Anal. Chem., 35: 10-13(Jan. 1963).

A method to determine small amounts of phosphorus in hypereutectic aluminum−silicon alloys is described. The method consists of the thermal neutron activation of the alloy followed by its complete dissolution in 1 to 3 hydrofluoric−nitric acid mixture. The phosphoric acid so formed is converted to the molybdophosphoric acid complex which is extracted into isobutyl alcohol. The isotope P^{32} is then determined by a β-counting technique using a liquid counter. Extraction of phosphorus is highly efficient and selective, and the loss of phosphine on dissolution in the acid mixture used is negligible. (auth)

5995 VANADYL ION AS A BACK-TITRANT FOR INDIRECT AMPEROMETRIC TITRATIONS WITH (ETHYLENEDINITRILO) TETRAACETIC ACID. APPLICATION TO THE DETERMINATION OF Al^{+3}, Zr^{+4}, AND Th^{+4} IN FLUORIDE-BEARING MATERIALS. Gerald Goldstein, D. L. Manning, and H. E. Zittel (Oak Ridge National Lab., Tenn.). Anal. Chem., 35: 17-21(Jan. 1963).

A rapid and precise method was developed for indirect amperometric titrations with EDTA in which VO^{2+} is used as the back-titrant. EDTA is added in excess to the test solution, and the excess, in an acetate-buffered medium of pH 4, is then titrated with VO^{2+}. The equivalence point is detected with a platinum-foil electrode maintained at a potential of +0.6 volt vs S.C.E. At this potential VOY^{2-} is not oxidized but VO^{2+} is; therefore, the presence of excess titrant is indicated by a linear increase in current. In general, any cation that forms an EDTA chelate having a stability constant of 10^{16} or greater can be determined. The relative standard deviation is about 1%. Fluoride and phosphate were tested as masking agents to increase selectivity. The method was applied to the determination of Al^{3+}, Th^{4+}, and Zr^{4+} in fluoride-bearing materials. (auth)

5996 EFFECT OF TEMPERATURE ON SPECTROPHOTOMETRIC MEASUREMENTS OF MOLYBDENUM(V) SOLUTIONS. S. Z. Mikhail and D. F. Paddleford (Kansas State Univ., Manhattan). Anal. Chem., 35: 24-7(Jan. 1963).

Beer's law holds for Mo(V) solutions below 0.01N between room temperature and 55°C. The rate of change of absorbance with concentration increases linearly with temperature, but the position of the absorption peaks and the mode of increase of absorbance with acidity are not affected. Temperature increases the absorption at every wavelength, but the rate of increase is wavelength-dependent. Acidity increases the temperature dependence of absorbance, at a rate linear with Mo(V) concentration. An equation relating absorbance of Mo(V) to temperature and concentration has been developed, which makes it possible to calculate the Mo(V) concentration at any temperature and concentration in the range investigated. Two methods of solving the constants arising in the equation are suggested. (auth)

5997 DETERMINATION OF REFRACTORY METALS IN FERROUS ALLOYS AND HIGH-ALLOY STEEL BY THE BORAX DISK X-RAY SPECTROCHEMICAL METHOD. C. L. Luke (Bell Telephone Labs., Inc., Murray Hill, N. J.). Anal. Chem., 35: 56-8(Jan. 1963).

X-ray spectrochemical methods were developed for the determination of Mo, W, Nb, and Ta in heat-resisting and corrosion-resisting alloys and of Mo and W in high-alloy steel. The refractory metals are separated from the bulk

of the alloy matrix by conventional chemical separations, converted to oxides, fused in borax, and then determined by x-ray spectrochemical analysis. The methods are convenient, rapid, and yield excellent results. (auth)

5998 EXTRACTION-FLAME PHOTOMETRIC DETERMINATION OF BORON. William J. Maeck, Maxine E. Kussy, Burton E. Vernon Wheeler, and James E. Rein (Phillips Petroleum Co., Idaho Falls, Idaho). Anal. Chem., 35: 62-5(Jan. 1963).

Submilligram quantities of boron were completely extracted from aqueous solution into methyl isobutyl ketone as the tetrabutylammonium boron – tetrafluoride ion association complex. The boron content of the separated organic phase was determined by direct flame spectrophotometric analysis, using an oxygen-sheathed oxyhydrogen flame as the excitation source. Of 30 metal ions studied, only five interfered at a 1 to 1 mole ratio to boron. Interfering anions were phosphate, perchlorate, and high levels of nitrate. Nitrate interference was eliminated by sulfuric acid fuming prior to extraction. (auth)

5999 DETERMINATION OF THE TRUE CHLORIDE CONTENT OF BIOLOGICAL FLUIDS AND TISSUES. I. ANALYSIS BY CHLORINE-36 ISOTOPE DILUTION. Ernest Cotlove (National Heart Inst. Bethesda, Md.). Anal. Chem., 35: 95-100(Jan. 1963).

An isotope dilution method using Cl^{36} is described in which the true value of the total chloride content of a sample of biological fluid or tissue can be measured with a precision of ±0.6% (relative standard deviation) for amounts of 150 to 250 μequiv of chloride. The method involves complete isotopic exchange of stable with added radioactive chloride in a solution formed by hot alkaline digestion of the sample, and determination of the correct value of the diluted specific activity in purified solutions obtained by successive stages of alkaline dry ashing, oxidation-reduction, and distillation. Radioassay was performed by infinite thickness liquid counting, and chemical assay was by automatic coulometric-amperometric titration with silver ion. The true chloride contents of tissues of normal adult rats, dogs, and frogs were lower than most values previously reported, particularly for muscle and liver. The isotope dilution method described can serve as a standard of reference for the evaluation and validation of simpler methods of chloride measurement in biological materials. (auth)

6000 PROGRAMMED CRYOGENIC TEMPERATURE GAS CHROMATOGRAPHY APPLIED TO THE SEPARATION OF COMPLEX MIXTURES. Charles Merritt, Jr. and John T. Walsh (U. S. Army Quartermaster Research and Engineering Command, Natick, Mass.). Anal. Chem., 35: 110-13(Jan. 1963).

The development of a technique for separating multicomponent mixtures of highly volatile compounds by programmed temperature gas chromatography and in the low temperature range, below room temperature, is reported, and its application to the analysis of some complex mixtures of volatile compounds isolated from foodstuffs is described. Some of the advantages gained by employing programmed temperature gas chromatography in the cryogenic temperature range are given. Chromatograms for the separation of volatile components from irradiated ground beef and ground roasted coffee beans are illustrated. (P.C.H.)

6001 DETERMINATION OF MICROGRAM QUANTITIES OF ZINC IN HIGH PURITY URANIUM. R. Bircz, S. Held, and I. Schoenfeld (Israel Atomic Energy Commission, Tel-Aviv). Bull. Res. Council Israel, Sect. A, 11: 170-7(Oct. 1962).

Microgram quantities of zinc were separated from uranium as an anionic complex in hydrochloric acid using an ion exchange technique. The completeness of the separation was confirmed using Zn^{65} as tracer. Zinc in the eluate was determined spectrophotometrically using zincon as complexing agent. The coefficient of variation was 7 – 3% for 20 to 40 ppm of Zn. The relative error of accuracy was from –7 to +2.4%. The limit of detection was 5 ppm of Zn. (auth)

6002 TITRIMETRIC DETERMINATION OF HAFNIUM IN ADDITION TO ZIRCONIUM. Franz Matthes, Theo Boethin, and Roman Rybak. Chem. Tech., (Berlin), 14: 550-2 (Sept. 1962). (In German)

A method for the determination of hafnium and zirconium together was perfected. It depends on the combination of the gravimetric with the titrimetric determination. This mehod, which adapted the conditions of the separation of hafnium from zirconium by countercurrent extraction with tributyl phosphate, is suitable in principle for all cases of the determination of Hf and Zr together. (If a definite mass of pure oxide mixture is present, it is sufficient to decompose them with hydrofluoric and sulfuric acids and to determine them titrimetrically. The gravimetric determination is unnecessary in this case). The method developed earlier for the titrimetric determination of Zr was used as the foundation for the present method. The Hf and Zr could be determined with limits of error of ±0.5% in the presence of each other. (tr-auth)

6003 MICRODOSAGE OF RADIUM IN SOLUTION WITH THE AID OF NUCLEAR PHOTOGRAPHIC EMULSIONS. M. Debeauvais-Wack (Centre de Recherches Nucléaires, Strasbourg). Intern. J. Appl. Radiation Isotopes, 13: 483-6(Sept. 1962). (In French)

A new absolute method is described for the dosage of equilibrium solutions of radium or uranium requiring only very small quantities of liquid of the order of mm^3. The process is based on noting the number of 4 branch stars produced in the nuclear emulsion by radium and its short-lived descendants. The diffusion of radon is stopped by working at a low temperature. This method permits the determination of radium concentrations as low as 10^{-13} c/cm^3. (auth)

6004 DISTRIBUTION OF SPECIES ALONG A BAND IN SEPARATIONS BY DISPLACEMENT CHROMATOGRAPHY. Jagdish Shankar and T. R. Bhat (Atomic Energy Establishment, Trombay, India). J. Chromatog., 9: 461-71(Dec. 1962). (In English)

The distribution of species along the band during separation by displacement chromatography is discussed from a theoretical view point, using the concepts of the plate theory. Detailed calculations are presented for the determination of the concentration distribution in the rear and the front regions of the band, for the separation of two species originally present in equal amount and having a separation factor of 2. An experimental procedure is described for verifying the theoretical results. Data obtained for the separation of neodymium and samarium and of praseodymium and neodymium, using EDTA as eluant and copper as retaining ion confirmed the validity of the theoretical treatment. (auth)

6005 ON THE EMERGENCY AID IN RADIOIODINE INTOXICATION. V. P. Borisov. Med. Radiol., 7: No. 11, 27-31(Nov. 1962). (In Russian)

In experiments carried out on animals affected with radioiodine the effectiveness of some modes of emergency aid was studied. Thyrostatic substances, organic and inorganic compounds of iodine, insoluble salts of copper, silver,

and mercury, and radioprotective agents of the cysteamine-cystamine type were investigated. In radioiodine intoxication, the use of preparations that prevent the accumulation of the radioisotope in the thyroid gland in combination with radioprotective agents is advocated. To prevent the absorption of radioiodine from the alimentary tract it is expedient to employ calomel. (auth)

6006 PROGRESS IN QUANTITATIVE INORGANIC ANALYSIS, 1961. Robert Maurmeyer (Brooklyn Coll., N. Y.). Microchemical J., 6: 459-77(Sept. 1962).

A review is given on the quantitative determination of inorganic substances in the milligram or submilligram range. Discussion is divided into four categories: gravimetric micromethods, titrimetric micromethods, optical methods, and miscellaneous methods. 98 references are given to papers published during 1961. (P.C.H.)

6007 ON COMPLEXING OF ARSENAZO III WITH ELEMENTS. S. B. Savvin (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Analit. Khim., 17: 785-95(Oct. 1962). (In Russian)

The mechanism of arsenazo III complexing with metals is discussed. Two functional-analytical groups of the arsenazo III molecule form two almost isolated conjugated systems. Complexing with elements takes place only by one of them; this leads to the appearance of two absorption bands of the complex in the visible range. The arsenazo III molecule in a free state is non-complanar owing to steric hindrances caused by AsO_3H_2 groups. When complexing with elements, the molecule planarity may be partially restored, which is an additional factor promoting the considerable deepening of the color. The complex composition for Me (II) and Me (III) corresponds to MeR; for Me (IV) the compositions MeR and MeR_2 are possible depending on the acidity and the Me:R ratio. Elements with ionic radius less than 0.7-0.8 A do not give a color reaction with arsenazo III. The stability of complexes formed by the reagents of the arsenazo III type is apparently determined by the length of the system of the conjugation bonds of the reagent molecule, by the nature of substituents, and the ionic state of the azo group forming the functional-analytical group of the reagent. (auth)

6008 SPECTROGRAPHIC QUANTITATIVE DETERMINATION OF SMALL CONCENTRATIONS OF RARE EARTHS IN ROCKS AND MINERALS. A. K. Rusanov, V. M. Alekseeva, N. V. Ilyasova, and V. G. Khitrov (All-Union Scientific Research Inst. of Mineral Raw Materials, Moscow). Zh. Analit. Khim., 17: 809-19(Oct. 1962). (In Russian)

The direct simultaneous determination of rare earths in ores was carried out with a standard experimental error of 15% on a diffraction spectrograph (with the dispersion of 4-2 Å/mm) using an arc discharge for the spectrum excitation. The sensitivity of the determination was: 0.001 for Yb, 0.003 for Tm and Y, 0.005 for La, 0.01 for Nd, 0.03 for Pr, Gd, Dy, and Lu, 0.04 for Ce, and 0.05% for Sm, Eu, Tb, Ho, and Er. After rather simple chemical enrichment of the samples with rare earths, the sensitivity of their determination increased 30-100 times. (auth)

6009 THE INFLUENCE OF A SOLVENT MIXTURE COMPOSITION ON THE SEPARATION OF CERTAIN RARE EARTHS BY A PAPER CHROMATOGRAPHIC METHOD. A. K. Babko and M. E. Vdovenko (Inst. of General and Inorganic Chemistry, Kiev). Zh. Analit. Khim., 17: 820-4 (Oct. 1962). (In Russian)

A study was made on the influence of a solvent mixture composition in the paper chromatographic separation of a mixture of lanthanum, neodymium, and yttrium. Mixtures of diethyl ether with alcohols and ketones were studied by means of physico-chemical analysis. It was established that the differentiating action of a mixture of solvents is often more effective than that of each solvent separately. It was shown that the differentiating action of a solvent depends on its affinity with water. Optimum conditions were found for separating lanthanum, neodymium, and yttrium, depending on the composition of the solvent mixture. (auth)

6010 SPECTROPHOTOMETRIC DETERMINATION OF RARE EARTHS IN SOLUTIONS OF ETHYLENEDIAMINETETRA-ACETIC COMPLEXES. V. T. Mishchenko and N. S. Poluektov (Inst. of General and Inorganic Chemistry, Odessa). Zh. Analit. Khim., 17: 825-30(Oct. 1962). (In Russian)

To eliminate the effect of other elements on the value of the maximum absorption of rare earths, it was found expedient to carry out their absorption-spectrophotometric determination in solutions of ethylenediaminetetra acetic complexes. The absorption spectra of aqueous solutions of Pr, Nd, Sm, Eu, Gd, Dy, Ho, Er, Tm, and Yb complexes were studied. It was established that on complexonate formation most of absorption band maxima shift to higher wave lengths by 1-6 mμ. Certain absorption maxima, Er is an example, were observed to shift to lower wave lengths. The peak heights of many rare earth absorption bands in this case often increase 1.1-2.6 times, which, to a certain extent, increases the sensitivity of the method. At rare earth concentration (as oxides) about 10 mg/ml the optimum conditions for the photometric determination were the complexone III concentration of 0.1M, and the pH of the solution 8-9. Conditions were established for the determination of Pr, Nd, and Sm in a mixture of cerium rare earths in complexonate solutions; the sensitivity of the method was 0.03 mg/ml of Pr_6O_{11} and Nd_2O_3 and 0.07 mg/ml of Sm_2O_3. It was shown that under the conditions found the interferences were eliminated to a considerable degree in the presence of ammonium nitrate when Pr, Nd, and Sm were determined, and in the presence of ammonium acetate, when Nd was determined. (auth)

6011 TITRIMETRIC DETERMINATION OF BERYLLIUM BY MEANS OF SULPHOSALICYLIC ACID. L. P. Kalinchenko and I. I. Kalinichenko (Sverdlovsk Medical Inst., USSR and Kirov Ural Polytechnical Inst., Sverdlovsk, USSR). Zh. Analit. Khim., 17: 840-3(Oct. 1962). (In Russian)

Conditions were studied for the direct titrimetric determination of beryllium with a sodium salicylate or sulfosalicylate solution in the presence of alberon or acid chrome blue K. It was shown that most of the cations usually present in minerals and industrial materials containing beryllium were easily masked with complexone III and did not interfere with the determination of beryllium. (auth)

6012 DETERMINATION OF ZIRCONIUM IN THE PRESENCE OF LARGE QUANTITIES OF MOLYBDENUM AND TUNGSTEN. A. Ya. Sheskolskaya (Baikov Inst. of Metallurgy, Moscow). Zh. Analit. Khim., 17: 949-51(Nov. 1962). (In Russian)

A method for the determination of zirconium in the presence of large quantities of molybdenum and tungsten, without their separation beforehand, is based on zirconium precipitation with cupferron at pH 6.8 in the presence of tartaric and oxalic acids to retain molybdenum and tungsten in solution. The method permits the rapid and precise determination of zirconium in molybdenum and in tungsten-base alloys. (auth)

6013 CONCENTRATION OF SMALL QUANTITIES OF URANIUM ON ION EXCHANGE RESINS FOLLOWED BY ITS SPECTROGRAPHIC DETERMINATION. T. M. Moroshkina (Zhdonov Leningrad State Univ.). Zh. Analit. Khim., 17: 963-5(Nov. 1962). (In Russian)

A spectrochemical method is suggested for the determination of small quantities of uranium in ores containing zirconium. Uranium quantities of 10^{-5} g (0.005%) and more were reliably determined in ores up to the ratio of U : Zr = 1 : 250. The accuracy of the method is 8–10%. (auth)

6014 USE OF DIANTIPYRINYLPROPYLMETHANE FOR THE PHOTOMETRIC DETERMINATION OF OSMIUM IN THE PRESENCE OF RUTHENIUM. A. I. Busev and V. K. Akimov (Lomonosov Moscow State Univ.). Zh. Analit. Khim., 17: 979-84(Nov. 1962). (In Russian)

A method was developed for the spectrophotometric determination of osmium in the presence of ruthenium by means of diantipyrinylpropylmethane. The method permits determination 2 to 20 μg/ml of osmium in the presence of up to 40 mg/ml of ruthenium. Rhodium and palladium do not interfere. Platinum and palladium interfere with osmium determination. (auth)

6015 EXTRACTION-PHOTOMETRIC DETERMINATION OF BORON IN BERYLLIUM OXIDE. Z. K. Karalova and A. A. Nemodruk. Zh. Analit. Khim., 17: 985-9(Nov. 1962). (In Russian)

An extraction-photometric method is described for the determination of boron in ignited and not ignited beryllium oxide. The method includes the decomposition of the sample with hydrofluoric acid followed by the extraction of brilliant green tetrafluoborate with benzene and by the measurement of the optical density of the extract obtained. The sensitivity of the method is 5×10^{-6}%. The experimental error for the determination from 5×10^{-5} to 2×10^{-3}% of boron in beryllium oxide is not more than 10%. (auth)

6016 USE OF CHLORPHOSPHONAZO III FOR THE PHOTOMETRIC DETERMINATION OF TITANIUM; ZIRCONIUM, THORIUM AND SCANDIUM. V. I. Fadeeva and I. P. Alimarin (Lomonosov Moscow State Univ.). Zh. Analit. Khim., 17: 1020-3(Nov. 1962). (In Russian)

The behavior of chlorphosphonazo III and its compounds with thorium, zirconium, titanium, and scandium was studied. The molar extinction coefficient of solutions of Th, Zr, Ti, and Sc compounds at 690 mμ were correspondingly, 43100, 33000, 10800, and 12500; the apparent equilibrium constants were: $pK_{Th} = 13.9$; $pK_{Zr} = 113.4$; $pK_{Ti} = 5.7$; and $pK_{Sc} = 6.9$. (auth)

6017 DETERMINATION OF AMMONIUM IONS AND FREE ACID IN AMMONIUM FLUOBERYLLATE SOLUTIONS. E. P. Shcheglova (Inst. of Engineering Physics, Moscow). Zh. Analit. Khim., 17: 1024-6(Nov. 1962). (In Russian)

A study was made of the possibility of determining free acid and ammonium ions in industrial ammonium fluoberyllate solutions. Acid is determined by potentiometric titration with an alkali solution to pH 7. Ammonium ions are determined by titration with alkali in the presence of formaline and sodium fluoride. (auth)

6018 METODY OPREDELENIYA I ANALIZA REDKIKH ELEMENTOV. (Determination and Analysis of Rare Elements.) A. P. Vinogradov, ed. Moscow, Publishing House of the Academy of Sciences, 1961. 668p.

Eighteen articles are included on determination and analysis of rare earths. The articles are organized according to the position of the metal in the periodic table and include physicochemical and chemical methods of analysis of ore and pure metal. Separate abstracts have been prepared for five articles. (R.V.J.)

6019 THE UP-TO-DATE ANALYTICAL CHEMISTRY OF SCANDIUM AND YTTRIUM RARE EARTHS. D. I. Ryabchikov and V. A. Ryabukhin. p.128-41 of "Metody Opredeleniya i Analiza Redkikh Elementov." Moscow, Publishing House of the Academy of Sciences, 1961.

Descriptions are given of optical, nuclear, and chromatographic separation methods for Sc and Y groups. Separate procedures are included for the separation of small amounts (10^{-2} to 10^{-4}%) of rare earth from soil and rock. Spectral determination of La, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tu, and Y and direct determination of Sc in tungstate, cassiterite, and beryllium are described. Data are also given on the photometric determination of individual rare earths and of mixtures in minerals and ores. Spectrophotometric determination of Pr, Nd, Ho, Er, and Tm without preliminary separation and flame-photometric determination of Eu, Yb, and Y in rare earth oxides are described as well as determination of Yb in Y in concentrates and photocolorimetric determination of Ce in Ni alloys. The neutron-activation method and equipment for rare earth determination is described. The oscillographic-polarographic method of Yb determination in the presence of large amounts of Er, spectral determination of Pb, Sn, Ca, and Bi in Ce and La and flame-photometric determination of Ca in rare earth salts are also discussed. Extensive bibliographies are included. (R.V.J.)

6020 THE UP-TO-DATE STATE OF ANALYTICAL CHEMISTRY OF Zr and Hf. S. V. Elinson. p.303-25 of "Metody Opredeleniya i Analiza Redkikh Elementov." Moscow, Publishing House of The Academy of Sciences, 1961.

An analysis is made of the more efficient methods for determining macro- and micro-quantities of Zr and of the alloying elements influencing the physical and mechanical properties of zirconium. Special studies were made of the influence of Hf (the presence of 1 to 2% Hf increases the neutron capture cross section of Zr from 0.18 to 1 barn). The chemical properties of aqueous zirconium solutions are analyzed, and Zr separation by precipitation and gravitation are discussed. Solvent extraction of Zr from Hf and other admixtures is analyzed as well as chromatographic separation and photometric and other physical methods of Zr and Hf determination. The influence of gases (N, O, H, and C) on the corrosion stability of Zr was analyzed, and various chemical methods of gas determination in Zr are described. Separate treatments are given to x-ray determination of Zr and Hf in rocks, ores, and minerals; direct quantitative spectrographic determination of Hf in ores; photometric determination of Zr in ore by arsenazo; photometric determination of Zr in phosphorite and other ores by pyrocatechin violet; gravimetric determination of Zr in concentrates, alloys, and other materials using amygdalic acid; volumetric determination of Zr in Nb, U, and other alloys, determination of Al, Be, Mg, U, Zn, and Ta in Zr alloys; spectral determination of Hf in $ZrO_2 - HfO_2$ by β reflection and by isotopic dilution. Extensive bibliographies are included. (R.V.J.)

6021 UP TO DATE ANALYTICAL CHEMISTRY OF THORIUM. D. I. Ryabchikov and E. K. Korchemnaya. p.374-88 of "Metody Opredeleniya i Analiza Redkikh Elementov." Moscow, Publishing House of the Academy of Sciences, 1961.

Analytical chemistry of Th and Th alloys is reviewed, and various conventional physical and chemical methods of Th determination are outlined. Solvent extraction of Th

from rare earths and other metal admixtures are discussed as well as determination of Th by fractional evaporation followed by spectral analysis and other methods. Separate procedures are given for determination of Th in ores by a direct photometric method using arsenazo(III) and using arsenazo(III) following ion exchange enrichment; ion exchange and trilonometric determination of Th in monazite concentrates; and luminescence determination of small amounts of Gd, Sm, and Eu in Th. 286 references are included. (R.V.J.)

6022 UP TO DATE DATA ON Ta and Nb ANALYTICAL CHEMISTRY. I. P. Alimarin and G. N. Bilimovech. p.487-98 of "Metody Opredeleniya i Analiza Redkikh Elementov." Moscow, Publishing House of the Academy of Sciences, 1961.

Data are given on the spectrochemical determination of Nb and Ta in ores and minerals; separation of Nb and Ta in ores by phenylarsonic acid; separation of Nb and Ta from Ti and Nb from Zr by selenious acid; cyclohexane solvent extraction of Ta from Ti; chromatographic separation of Nb and Ta from Ti, analysis of Nb–Ta alloys by β emission, extractions and photometric determination of Ta in metallic Zr, Hf, and Nb; polarographic determination of Nb, Ti, and Fe in Ta and Ta compounds; oscillographic determination of Nb in Nb–Ta alloys, chemical-spectral determination of Bi, Cd, Sb, Sn, Pb in metallic tungsten, niobium, and tantalum; and determination of He, O, and N in Nb, Mo, and W by vacuum melting using an iron bath. 130 references are included. (R.V.J.)

6023 SPECTROSCOPY. Report of the Conference Organized by the Hydrocarbon Research Group of the Institute of Petroleum and Held in London, March 1962. M. J. Wells, ed. London, Institute of Petroleum, 1962. 310p.

Studies are described of: uses and techniques of spectroscopy; x-ray-fluorescence, nuclear-magnetic-resonance, and electron-magnetic-resonance spectroscopy; free-radical spectroscopy and flame spectrophotometry; atomic, radical, and molecular absorption spectroscopy; group frequency shifts; rotation in solutions and solvent effects on infrared spectra; infrared and ultraviolet spectroscopy; and vibrational bands. (T.F.H.)

6024 ANALITICHESKAYA KHIMIYA REDKIKH ELEMENTOV. (Analytical Chemistry of Rare Elements). N. P. Popov, ed. Moscow, State Publishing House of Scientific Technical Literature on Geology and Natural Resources, 1960. 176p.

A survey is given on quantitative and qualitative analyses of rare earths and scattered elements in ores and in metallurgically treated materials. The book is divided into two sections: The first section deals with systematic, analytical procedures and separation and concentration of rare earths. The second section describes the principal rare earth compounds, concentration methods, and quantitative and qualitative analytical methods for complex compounds. 415 references are included. (R.V.J.)

6025 ANALYSIS OF NEPTUNIUM. J. S. Buckingham (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 27, 1962. 7p. (HW-SA-2769)

To be published in Proceedings of AEC Contractor Session on Nuclear Material Management, held in Chicago, Ill., October 3-5, 1962.

The purified Np produced at Hanford has been analyzed by several different methods. The methods are discussed and the analytical results are summarized and compared. Compared to the overall average, alpha counting corrected by alpha energy analysis was high and x-ray photometer was low. Results from other methods were reasonably close to the average. (auth)

6026 REACTOR-PRODUCED SHORT-LIVED RADIOISOTOPES USED IN NEUTRON ACTIVATION ANALYSIS. Vincent P. Guinn (General Atomic Div., General Dynamics Corp.). IAEA Preprint SM-32/27. 21p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The role of various parameters in activation analysis is discussed with special reference to reactor fluxes and cross sections, and to short-lived induced activities. A few of the regularly used thermal neutron-induced activities are mentioned. Examples of the utilization of these activities in analyses, and the corresponding sensitivities of detection at a thermal flux of 1.8×10^{12} n/sec cm^2 are given. The results of regular use of reactor fast neutrons for activation analysis are cited. The use of high-intensity reactor pulses, for neutron activation studies, is discussed. Details of the pulse technique and examples of its use are presented. (W.D.M.)

6027 DETERMINING TRACES OF IMPURITIES IN BERYLLIUM BY NON-DESTRUCTIVE METHODS. J. Petit and C. Engelmann (Centre d'Études Nucléaires, Saclay, France). IAEA Preprint SM-32/28. 10p. (In French)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

By using a magnetic-memory multichannel analyzer and subtracting, one from another, two spectra of the same sample recorded at a suitable interval of time, it is possible to obtain the spectra of the short-lived nuclides. This method has been used particularly for determining the aluminium present in beryllium; the sensitivity was 0.05 ppm and a dozen analyses were made per hour. The gamma-gamma coincidence spectrum was used to determine the copper content of beryllium in the presence of numerous other impurities, with a sensitivity of less than 1 ppm. (auth)

6028 ACTIVATION ANALYSIS AND DETERMINATION OF SHORT-LIVED ISOTOPES. R. Loos (Université Lovain, Léopoldville, Congo). IAEA Preprint SM-32/30. 8p. (In French)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The Lovanium University, Leopoldville, is working in close collaboration with the Trico Centre, which has a Triga (General Atomics) reactor of 50 kw maximum power. The reactor is located close to the nuclear Physics Department where analysis of irradiated specimens is mostly carried out. This close proximity makes it possible to determine isotopes of a few minutes' half-life, there being advantage in this case in using the pneumatic tube (flux: 10^{12} n/cm^{2}sec). For isotopes of longer life, irradiation is done in the rotary rack or the central thimble. Measurement of gamma spectra is done by means of a 400-channel analyzer; working in 4 sub-groups of 100 enables rapid disintegration curves to be followed. In some cases study of the coincidence spectrum with a second detector may be useful. (auth)

6029 THE USE OF SHORT-LIVED RADIOACTIVE ISOTOPES IN AN ACTIVATION ANALYSIS SERVICE PROGRAMME. D. Gibbons and H. Simpson (Wantage

Research Lab., Wantage, Eng.). IAEA Preprint SM-32/34. 17p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The uses of short-lived radioisotopes in activation analyses are illustrated by reference to actual analytical problems encountered in the operation of an activation analysis service program. Thus, in the determination of rubidium in caesium salts, the use of 10-minute Rb^{86m} considerably reduces the build-up of matrix activity with little loss in sensitivity. In the determination of calcium in tissue, 8.8 minute Ca^{49} gives quicker results since the irradiation time is much reduced and the decay curve can be followed for a reasonable number of half-lives in less than an hour. The determination of selenium can be accomplished non-destructively in some biological materials with enhanced sensitivity using 17.5 second Se^{77m}. In complex materials, where a chemical separation is necessary, 18.6 minute Se^{81} still gives a more favorable sensitivity than Se^{75}. In the determination of cobalt in nickel salts, long irradiations to produce Co^{60} produce interfering amounts of Co^{58} by the (n,p) reaction on nickel. Short irradiations, followed by measurement of 10.5 minute Co^{60m}, reduce this interference considerably and also give an improved sensitivity. Several types of automatic units for use in counting short-lived radioisotopes are described, including photographic recording techniques, an automatic sample changer and various programming units. (auth)

6030 THE USE OF THE 10 kW ARGONAUT REACTOR AT PETTEN FOR RADIOACTIVATION, INCLUDING THE QUANTITATIVE ASPECTS OF SHORT-TIME IRRADIATIONS. H. A. Das (Reactor Centrum Nederland, Petten, Netherlands). IAEA Preprint SM-32/35. 20p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

Some problems and possibilities in performing activation analysis with a small reactor using short irradiation times are described. A brief survey is given of the reactor and its application for chemical purposes. Three problems occurring in working with a small reactor and the solutions for them are discussed: (1) The calibration of short-lived radioisotopes using direct γ-spectroscopy; (2) The evaluation of the inevitable errors adherent in activation analysis using short irradiation times; (3) The analytical use of (n,α) reactions by measurement during irradiation. Some results are mentioned. (auth)

6031 PRACTICAL APPLICATIONS OF SHORT-LIVED RADIONUCLIDES IN ACTIVATION ANALYSIS. B. Chinaglia, L. Ciuffolotti, G. B. Fasolo, and R. Malvano (SORIN, Saluggia, Italy). IAEA Preprint SM-32λ36. 8p. (In French).

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

Activation analysis by means of short-lived radionuclides has found some remarkable applications in the SORIN Research Centre at Saluggia. The special techniques of irradiation, chemical separation, and measurement required to obtain adequate accuracy and good sensitivity are described. It has proved possibly to apply the method to analysis of elements with a half-life down to 10 sec, with a consequent enormous gain in time. The method has been of benefit in several different spheres, as in solving metallurgical and technical problems and in geochemistry and biology. (auth)

6032 DETERMINATION OF UREA. Leon Velluz, Daniel Bertin, and Rene Berret (to Roussel-UCLF Societe Anonyme). U. S. Patent 3,068,071. "Priority date May 14, 1958, France."

A process is described for the preparation of a radioactive xanthydrol tagged with carbon-14 and its use in the microassay of urea in small amounts of physiological fluids. (R.J.S.)

Inorganic and Physical Chemistry

Refer also to abstracts 6584, 7121, and 7127.

6033 (BM-RI-6146) HEAT OF SOLUTION OF CERIUM METAL IN HYDROCHLORIC ACID. R. L. Montgomery (Bureau of Mines. Reno Metallurgical Research Center, Nev.). Apr. 1962. 11p.

Heats of solution of Ce metal and cerium(III) chloride in HCl were measured. The standard heat of formation of the aqueous cerium(III) ion at 25°C is -166.1 ± 0.3 kcal/mole. Heats of solution of cerium(III) chloride in HCl are consistent with the existence of a complex $CeCl^{2+}$ having a stability constant of 1 and a heat of complexing of 5.4 kcal/mole. (auth)

6034 (BNL-5559) AN ELECTRON SPIN RESONANCE STUDY OF IRRADIATED QUATERNARY AMMONIUM HALIDES. A. J. Tench (Brookhaven National Lab., Upton, N. Y.). [1960]. Contract [AT-30-2-GEN-16]. 6p.

Experiments to obtain data on the ESR spectra in irradiated tetramethyl ammonium halides are described. The spectra were measured at either 298 or 77°K. A discussion of properties and the behavior of the various halides is included. (J.R.D.)

6035 (DP-511) TECHNIQUES FOR THE DETERMINATION OF TRITIUM. A Literature Search. Myra S. Feldman (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). June 1962. Contract AT(07-2)-1. 56p.

A total of 196 references is presented on the quantitative determination of tritium. Labeling and tracer studies and processes of tritium separation were not within the scope of this search. Literature was covered from about 1907 to November 1961. References are arranged under broad subjects. Documents are listed alphanumerically, and all other references are listed alphabetically by author or by title if no author is given. An author index is provided. (R.J.S.)

6036 (GA-1536) THE HIGH-TEMPERATURE CHEMISTRY OF FISSION-PRODUCT ELEMENTS. Summary Report, August 1, 1959 through July 31, 1960. U. Merten and W. Bell (General Atomic Div., General Dynamics Corp., San Diego, Calif.). July 29, 1960. Contract AT(04-3)-164. 20p.

Since the issuance of the last summary report, an account of work on the dissociation pressure of $RuCl_3(s)$ was published, and a paper on vaporization data on the $Ru-Cl_2$ system at 650 to 1500°C is being submitted for publication. In the latter work, $RuCl_3$ and $RuCl_4$ were identified as major gaseous species. In addition, a paper on the phase-behavior, dissociation-pressure, and vaporization data on the $Pd-Cl_2$ system is being submitted for publication. Developments which resulted from a study of the $Pd-Cl_2$ system include the identification of $PdCl_2$ and the gaseous polymer Pd_5Cl_{10} as the major gaseous species. Pd metal was shown to be appreciably soluble in liquid $PdCl_2$. As a

result of x ray studies of the $Rh-Cl_2$ system, it was shown that the previously reported $RhCl_2$ and RhCl do not exist. Preparations are being made for vapor-pressure studies of the $Rh-Cl_2$ system at 1000 to 1500°C. Work was performed using infrared techniques to determine the molecular structure of $RuCl_4(g)$; the results suggest a tetrahedral structure. As previously mentioned, because of interesting developments in the Ru, Rh, and Pd systems, studies of the closely related Os, Ir, and Pt systems are contemplated, and work was begun at 500 to 1000°C on the $Os-Cl_2$ system. (J.R.D.)

6037 (HW-SA-2537) CATION AND ANION EFFECTS ON THE DISTRIBUTION OF URANIUM IN THE SYSTEM: ALUMINUM–ALUMINUM HALIDE–ALKALI HALIDE. R. H. Moore (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Apr. 13, 1962]. Contract [AT(45-1)-1350]. 15p.

A study of the reduction of uranium(III) chloride, in solution in molten $KCl-AlCl_3$ mixtures, by molten aluminum was extended to include the effect of substitution of Na^+ or Cs^+ for K^+ and of Br^- for all, or part, of the Cl^-. Substitution of Na^+ for K^+ hinders the reduction of uranium chloride whereas substitution of Cs^+ for K^+ enhanced the reduction. The effect is in the direction anticipated in view of the relative chloride donor strengths of these alkali chlorides. The reduction of uranium bromide by Al in the system $KBr-AlBr_3-Al$ occurs to a lesser extent than in the analogous chloride system. On the other hand, substitution of from 5 to 10 mole percent of the chloride by bromide results in markedly enhanced reduction. These results are explained in terms of the relative strengths of the $AlCl_4^-$ and $AlBr_4^-$ complexes and the relative stabilities of UCl_3 and UBr_3. (auth)

6038 (IA-763) CHARGE-TRANSFER COMPLEXES OF IODINE AND INORGANIC ANIONS IN SOLUTION. D. Meyerstein (Israel. Atomic Energy Commission, Rehovoth) and A. Treinin (Hebrew Univ., Jerusalem). Sept. 1962. 21p.

In aqueous solution iodine forms complexes with several anions including halides, CNS^-, and N_3^-. Their spectra and stability constants were determined. Energetic evidence is presented indicating that these are charge-transfer complexes and that their characteristic intense absorption bands are due to electron transfer from the anion to iodine. The structure of polyhalides and their photochemistry are discussed. (auth)

6039 (IS-445) SOME OBSERVATIONS REGARDING RARE-EARTH LACTATES. J. E. Powell and J. L. Farrell (Ames Lab., Ames, Iowa). [Mar. 28, 1962]. Contract [W-7405-eng-82]. 12p.

Lactates of all the rare earths except lanthanum, cerium, and praseodymium were prepared and studied. In the case of lanthanum, cerium, and praseodymium the lactates are apparently so soluble that they cannot be crystallized directly from aqueous solution. Products obtained by addition of anhydrous ethanol to sirupy solutions of the light-rare-earth lactates were not well characterized and were deliquescent. Neodymium lactate trihydrate was prepared only by the addition of alcohol to a sirupy solution. Since it was not as deliquescent as the lactates of lanthanum, cerium, and praseodymium, some of its properties could be studied. The lactates of all the other rare earths, samarium through lutetium, as well as the lactate of yttrium, separated readily from aqueous media as trihydrates—the solubility of the hydrated lactate decreasing as the atomic number of the rare earth increased. Thermal decomposition of the crystalline lactates, except those of neodymium and samarium, proceeded through dihydrated and anhydrous states to a composition corresponding roughly to $LnlacCO_3$ at a temperature of about 290 to 300°C. $Ln_2(CO_3)_3$ or $Ln_2O(CO_3)_2$ was observed. In order to make a comparison, thermal decomposition of the rare-earth glycolates was studied also. Solubilities in water at both 20 and 60°C are tabulated. (auth)

6040 (JÜL-68-RC) UNTERSUCHUNGEN ÜBER DARSTELLUNG UND EIGENSCHAFTEN NEUER CYANO-KOMPLEXE DES VIER- UND EINWERTIGEN TECHNETIUMS. (Research on Preparation and Properties of New Cyano Complexes of Four- and Five-Valent Technetium). Klaus Schwochau (Kernforschungsanlage. Institut für Radiochemie, Jülich, Germany). Sept. 1962. 107p.

An attempt was made to prove the existence of cyano complexes of technetium, to stabilize labeled oxidation products of the radioactive element, and to determine the physical and chemical properties of the compounds. By dissolution of $Tc^{99}O_2$ hydrate in hot aqueous alkali cyanide solution a cyano technetium(IV) complex was formed. The composition was determined by radiometric and gravimetric analysis and nitrogen determination by the Kjeldahl-Parnas method. Cyano technetium complexes were also formed by the reduction of TcO_4^- ions with potassium amalgams in the presence of potassium cyanide. Spectra, properties, and structures of the compounds were determined. (M.C.G.)

6041 (LAMS-2781) AN ISOTOPE EFFECT IN THE RECOMBINATION OF IODINE ATOMS. Mark M. Rochkind (Los Alamos Scientific Lab., N. Mex.). Aug. 1962. Contract W-7405-eng-36. 28p.

The flash photolysis method was used to obtain the third order rate constants for iodine atom recombination in the presence of hydrogen and deuterium third body gases. Since the primary aim was to measure a possible isotope effect, a two-path flash photolysis system was used which allowed essentially simultaneous measurement of both isotope rates under the same conditions and with the same flash lamp discharge. The ratio of the iodine atom recombination rate for hydrogen to that for deuterium was determined to be 1.51 ± 0.28, compared to a value of 1.41 given by a simple kinetic theory of recombination based on an intermediate iodine atom third body complex. (auth)

6042 (NOL-TR-62-34) FERROMAGNETIC RESONANCE MEASUREMENTS IN GARNETS. G. E. McDuffie, Jr., R. F. Stauder, and L. J. Schwee (Naval Ordnance Lab., White Oak, Md.). Mar. 15, 1962. 34p. (AD-276577)

Techniques used for low power linewidth determinations and high power non-linear susceptibility measurements of polycrystalline garnet materials at X-band are described. It is shown that errors resulting from procedures employed are negligible for the range of linewidths encountered in polycrystalline garnet materials. Effects on the linewidth and on the d-c magnetic field necessary for resonance produced by single crystal grains in the polycrystalline material are discussed. (auth)

6043 (NP-12310) CHEMICAL THERMODYNAMICS OF MATERIALS AT HIGH TEMPERATURES. Final Report. Russell K. Edwards and Phillip G. Wahlbeck (Illinois Inst. of Tech., Chicago). June 30, 1961. Contract AF49(638)-346. 11p.

Progress is reported for research on thermoelectric power of liquid metal solutions, thermodynamics of the liquid Ga-In system, thermodynamic properties of metal-hydrogen systems, volume mixing of non-interacting

spheres of various radius ratios, and dissociation energies of gaseous diatomic S, Se, and Te. (M.C.G.)

6044 (NP-12311) ELECTRONIC ENTROPY IN LIQUID METAL SOLUTIONS (thesis). Lurance Marcine Webber (Illinois Inst. of Tech., Chicago). Jan. 1962. 59p.

The contribution to the entropy of mixing arising from the change in the statistical distribution of electrons when two metallic components are mixed was investigated. An attempt was made to evaluate the correlation between changes of the Seebeck coefficient on mixing of two components and the electric entropy of mixing. The liquid Sn–Zn alloy was investigated. Measurements in the Sn–Zn alloy of the thermoelectric potential difference with reference to pure liquid zinc were obtained over a temperature range of about 150°C. It was found that the sign of the excess Seebeck coefficient is in the right direction to give a positive electronic entropy contribution. (M.C.G.)

6045 (RAD-SR-62-251) THERMODYNAMICS OF CERTAIN REFRACTORY COMPOUNDS. PART II. CONTINUED THEORETICAL AND EXPERIMENTAL STUDIES ON AN EXTENDED LIST. Second Quarterly Progress Report, September 1 to November 30, 1962. H. L. Schick, D. F. Anthrop, R. E. Dreikorn, R. C. Feber, P. L. Hanst, M. B. Panish, and C. H. Ward (Avco Corp. Research and Advanced Development Div., Wilmington, Mass.). Dec. 15, 1962. Contract AF33(657)-8223. 152p.

The thermodynamic properties of refractory borides, carbides, nitrides, and oxides of some 31 elements are compiled. Several tables for elements and compounds not previously reported are presented, and the experimental spectroscopic studies of the vapor of boron oxide and hydroxide are discussed. (R.J.S.)

6046 (TID-13145) BOND LENGTHS IN SOLID HELIUM. A. F. Schuch (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 3p. (LADC-4912)

A solid phase of helium-4 exists between 1.45°K and 1.78°K, which is thought to have a body centered cubic structure. Bond length calculations are presented for both A2 and hexagonal closest packed structures. (R.J.S.)

6047 (TID-14535) CONCERNING THE VALENCES OF THE CERIUM ALLOTROPES. Karl A. Gschneidner, Jr. (Los Alamos Scientific Lab., N. Mex.), and R. Smoluchowski (Princeton Univ., N. J.). [1961]. Contract [W-7405-eng-36]. 17p. (LADC-5118)

An analysis of the metallic radii and magnetic susceptibility data concerning the α-, β-, γ-, and "α–γ intermediate" phases of cerium was made in order to estimate the metallic valences of these phases. At room temperature and pressure the metallic valences of β- and γ-Ce are estimated to be 3.05. The valence of α-Ce depends upon pressure and temperature, at 116°K and 1 atm the estimated valence is 3.62; at 298°K and 7670 atm, 3.51; and at the α–γ critical point, 3.25. The valence of the "α–γ intermediate" cerium phase was calculated to be 3.18. No evidence was found to support the existence of a tetravalent state in metallic cerium. It is noted that a valence of 4 for cerium is merely a convenient notation, but does not describe the true situation. A model, which accounts qualitatively for the observed facts, is proposed. (auth)

6048 (TID-14538) THERMODYNAMICS OF $PuCl_4$ FROM TRANSPIRATION DATA. R. Benz (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 13p. (LADC-5161)

The free energy change for the reaction $PuCl_{3(s)} + \frac{1}{2}Cl_{2(g)} = PuCl_{4(g)}$ in the temperature range 400 to 750° was determined from transport in chlorine carrier gas. The molar free energy of reaction may be represented by the relation $\Delta F = 37700 - 28.3\ T$(cal.), where T denotes degrees Kelvin. The standard free energy, enthalpy, and entropy of formation of $PuCl_4$ are estimated. (auth)

6049 (TID-15183) HEAT CAPACITY OF PLUTONIUM DIOXIDE BELOW 320°K. Thomas A. Sandenaw (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 25p. (LADC-5260)

The low temperature heat capacity behavior of PuO_2 was found to be anomalous and irreproducible, changing slightly after every one of 7 liquid He coolings. Data obtained from a second series of liquid He coolings, made after refiring 3 or 4 original PuO_2 wafers in air, were consistent with the last run of the first series. The final low temperature heat capacity vs temperature curve was more like that reported for ThO_2 than it was for similar curves reported for UO_2 and NpO_2. Least-squares equations relating heat capacity and temperature are given for 3 temperature regions. Calculated values of the energy density of states and θ_D are shown and values of entropy and enthalpy are listed for several temperatures. (auth)

6050 (TID-15323) SYNERGISM IN THE SOLVENT EXTRACTION OF DI-, TRI- AND TETRAVALENT METAL IONS. PART V. INFRARED STUDIES OF THE ISOLATED COMPLEXES. J. R. Ferraro and T. V. Healy (Argonne National Lab., Ill.). Dec. 1961. Contract [W-31-109-eng-38]. 20p. (UAC-5971)

In the synergistic extractions of metal ions with the systems 1,1,1-trifluoro-3-2'-thenoyl acetone (HTTA) and neutral organophosphorus compounds, stable complexes were isolated from the organic phase. These have the following formulas: $UO_2(TTA)_2S_1$, $UO_2(TTA)_2S_2$, $Th(TTA)_4S_1$ and Rare Earth $(TTA)_3S_2$, where S = a neutral organophosphorus compound. The infrared spectra of these complexes were obtanied and are discussed in terms of various possible structures. (auth)

6051 (TID-15360) CHLORO COMPLEXES OF NITROSYLRUTHENIUM. W. M. Campbell, Jr. and R. M. Wallace (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [Mar. 1962]. Contract AT (07-2)-1. 15p.

An investigation of the nitrosylruthenium chloro complexes formed in hydrochloric acid solutions showed the existence of a minimum of five monomeric complexes. The mono-, di-, tri-, tetra-, and pentachloro complexes were isolated by ion exchange and have the probable formulas $RuNOCl(H_2O)_4^{+2}$, $RuNOCl_2(H_2O)_3^{+1}$, $RuNOCl_3(H_2O)_2$, $RuNOCl_4(H_2O)^{-1}$, and $RuNOCl_5^{-2}$. Evidence was found for the presence of two dimeric chloro complexes, $[RuNOCl(H_2O)_3\text{-}O\text{-}RuNOCl_2(H_2O)_2]^{+1}$ and $[RuNOCl_3(H_2O)\text{-}O\text{-}RuNOCl_3(H_2O)]^{-2}$, in water solutions. An anionic species existing only in solutions of high HCl concentrations (12M) was isolated as a crystalline ammonium compound. The analysis and the anion exchange behavior of this compound indicate that the complex is a polymer of $[RuNOCl_5]^{-2}$. (auth)

6052 (TID-17413) THERMODYNAMIC PROPERTIES OF CARBIDES AT HIGH TEMPERATURES. Harry A. Eick, E. G. Rauh, and R. J. Thorn (Argonne National Lab., Ill.). Sept. 1962. Contract [W-31-109-eng-38]. 16p. (UAC-6904)

Currently available thermochemical data and numerous calculations involving comparisons and critical evaluations are presented concerning the carbides of Pu, Th, and U. Because of the difficulties involved, there are very few methods presently available which can be employed to determine the free energy and entropy of formation of a

condensed phase at temperatures above 2000°C. To date, extremely high precision in the measurements of rates of effusion in general have not been obtained. (R.J.S.)

6053 (TID-17447) VALENCE BAND STRUCTURE OF SILVER CHLORIDE. Robert S. Knox, Franco Bassani, and W. Beall Fowler, Jr. (Argonne National Lab., Ill., and Rochester, N. Y. Univ.). Sept. 1961. Contract [W-31-109-eng-38]. 10p. (UAC-6851)

Preliminary results of a study of the valence bands of AgCl are presented. It is found that in general, the 3p band associated with Cl^- lies within 1 ev of the 4d band associated with Ag^+ and that a strong interaction between them produces a many-hilled valence band with principal maxima lying at the point L (at the zone boundary in the 111 direction). These results seem to be consistent with current experimental results on indirect exciton absorption, and provide a tentative confirmation of a recently proposed screening correction to the Slater effective exchange potential. (auth)

6054 (UCRL-6500) THE THERMAL DECOMPOSITION OF THE RARE-EARTH SULFATES. THERMOGRAVIMETRIC AND DIFFERENTIAL THERMAL ANALYSIS STUDIES UP TO 1400°C. M. W. Nathans (California. Univ. Livermore. Lawrence Radiation Lab.) and W. W. Wendlandt (Texas Technological Coll., Lubbock). June 15, 1961. Contract W-7405-eng-48. 24p.

The thermal decomposition of the anhydrous rare-earth sulfates was studied by thermogravimetric analysis (TGA) and differential thermal analysis (DTA) up to a temperature limit of 1400°C. TGA curves showed that the thermal decomposition reaction took place in two steps. The first step corresponded to the formation of metal oxysulfates, $M_2O_2(SO_4)$, the second step corresponded to the formation of the metal oxides. DTA studies also revealed this decomposition pattern, giving as evidence two endothermic peaks. The heats of decomposition to the metal oxysulfates and sulfates were determined by quantitative DTA methods. Preliminary information was obtained on the kinetics of the decomposition reactions. (auth)

6055 (UCRL-7118) THE THERMODYNAMIC FUNCTIONS FOR WATER IN THE RANGE −10 TO 1000°C AND 1 TO 250,000 BARS. W. E. Sharp (California. Univ., Livermore. Lawrence Radiation Lab.). Oct. 23, 1962. Contract W-7405-eng-48. 51p.

These thermodynamic tables include information on temperature, pressure, specific volume, entropy, enthalpy, Gibbs free energy, internal energy, and Helmholtz free energy. (R.J.S.)

6056 (WRU-202) THE THERMODYNAMIC PROPERTIES OF SILICON TETRAFLUORIDE FROM 15°K TO ITS TRIPLE POINT. THE ENTROPY FROM MOLECULAR AND SPECTROSCOPIC DATA. E. L. Pace and J. S. Mosser (Western Reserve Univ., Cleveland. Morley Chemical Lab.). Nov. 28, 1962. Contract AT(11-1)-824. 16p.

The heat capacity of SiF_4 has been measured from 15 to 194°K for a sample of 99.79 mole % purity. The solid-liquid-vapor triple point temperature and pressure were 186.35°K and 1679.3 mm, respectively. The heat of fusion and heat of vaporization at the triple point were found to be 2242 cal/mole and 3555 cal/mole, respectively. The vapor pressure of the solid has been measured from 163 to 186.35°K and the data fitted to the equation $\log_{10}P_{mm} = -5.5025 - 894.93/T + 5.9593 \log_{10}T$. Only one vapor pressure point other than the triple point itself was taken for the liquid. The entropy of SiF_4 in the ideal gas state at a pressure of one atmosphere and a temperature equal to the triple point temperature of 186.35°K was found to be 59.89 ± 0.20 cal/(mole °K). This value agrees within the experimental uncertainty with the value of 60.037 cal/(mole °K) calculated theoretically from the molecular parameters and fundamental frequency assignment. (auth)

6057 (AEC-tr-5552) KINETICS OF REACTION BETWEEN TRIVALENT PLUTONIUM AND CHLORINE IN AQUEOUS CHLORIDE SOLUTIONS. A. S. Ghosh Majumdar and R. N. Singh. Translated from Vijnana Parishad Anusandhan Patrika, 4: 173-8(1961). 8p.

The kinetics of Pu(III) oxidation to Pu(IV) by free Cl was found to depend on the chloride ion concentration and on the initial concentration of the two reactants, but independent of acidity. In a specified chloride ion concentration, the oxidation reaction appears to be first order with respect to both the reactants, taken together. (J.R.D.)

6058 (AEC-tr-5566) THE ORIENTATION OF LARGE SINGLE CRYSTALS PREPARED FOR THE PURPOSE OF NEUTRON-MONOCHROMATIZATION. Pál Szabó and Emil Krén. Translated for Argonne National Lab., Ill. from Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 7: No. 6, 366-73(1959). 9p.

An x-ray diffraction procedure (based on the method of crystal orientation with the aid of back-reflection Laue photographs) was devised for the determination of the single-crystal character of large monochromator crystals used in neutron-diffractometers and crystal spectrometers and for the necessary orientation of such crystals when cutting prescribed crystallographic planes into them. For this procedure, a special goniometer with suitable chucks for the crystal was built. A cubic (111) stereographic projection of suitable accuracy was prepared. The accuracy of the orientation is discussed and this accuracy was checked by experiments. (auth)

6059 (CEA-tr-R-1541) SIMILITUDES THERMODYNAMIQUES DE L'EAU LOURDE ET DE L'EAU ORDINAIRE. (Thermodynamic Similarities of Heavy Water and Ordinary Water). P. M. Kesselman. Translated into French from Teploenerg., No. 3, 83-7(1963). 16p. (Includes original, 4p.).

Superheated vapor of heavy water and ordinary water is subordinated to the law of corresponding states in the density interval $\omega = 0$ to 1.4 and temperatures from 350 to 500°C. By using the carefully studied properties of ordinary water, the thermal properties of heavy water in zones not included in experience can be calculated. The thermodynamic similarity determined for heavy and light water gives the possibility of obtaining also in a comparatively simple manner some thermal properties of D_2O. (tr-auth)

6060 DIFFUSION IN MIXED SOLVENTS. John T. Holmes, D. R. Olander, and C. R. Wilke (Univ. of California, Berkeley). A.I.Ch.E. (Am. Inst. of Chem. Engrs.) J., 8: 646-9(Nov. 1962).

The transport of toluene in n-hexane-n-tetradecane; n-hexane-cyclohexane; and cyclohexane-n-decane was investigated. The entire binary composition range in each of the solvents was covered. The experimental diffusivity, viscosity, and density data for the systems are tabulated. The binary diffusivity data were between 5 to 9% higher than those previously reported by others either because of differences in solvent purity or possibly because of the previous utilization of Beer's law in the spectrophotometric analyses. (P.C.H.)

6061 PRODUCTS WHICH ARE FORMED BY HEATING AT VARIOUS TEMPERATURES COPRECIPITATES OF THE PHOSPHATES OF CALCIUM AND THORIUM. Carlo Bettinali and Aldo La Ginestra (Università, Rome). Atti

Accad. Nazl. Lincei. Rend., Classe Sci. Fis., Mat. Nat., 32: 83-6(Jan. 1962). (In Italian)

The possible isomorphic substitution of Ca in hydroxyapatite with tetravalent elements with similar ionic radius was studied. To verify such a substitution, various mixtures of the phosphates of Ca and Th, obtained by coprecipitation, were heated to increasing temperatures. The results are summarized. The compounds $CaTh(PO_4)_2$, ThO_2, and ThP_2O_7, were formed by solid state reactions in mixtures with ratios Ca/Th < 1, and $CaTh(PO_4)_2$ was formed in mixtures with ratios Ca/Th ≃ 1. In mixtures with ratios Ca/Th > 1, $CaTh(PO_4)_2$, ThO_2, calcium metaphosphate, and calcium polyphosphate are formed. In mixtures with high calcium phosphate excess β-$Ca_3(PO_4)_2$ is formed. The results showed that under the conditions given no substitution occurs. (J.S.R.)

6062 THERMAL AGITATION IN MOLECULAR CRYSTALS: THE SCATTERING OF X RAYS BY ACRIDINE III. J. L. Amorós, A. de Acha, and M. L. Canut (Departamento de Cristalografía, C.S.I.C., Madrid). Bull. Soc. Franc. Mineral. Crist., 84: 40-50(Jan.-Mar. 1961). (In French)

The thermal scattering of x rays by acridine III at room temperature was studied, beginning with Laue diagrams. The regions of continuous thermal scattering are interpreted by a transformed Fourier difference function (TFD) and the model of independent movement of the four molecules of the unit cell. The model, which considers the movement coupled with pairs of molecules, is not in accord with the regions studied. After calculation of the approximate value of the characteristic Debye temperature (θ = 41°K), the behavior of the Laval functions of the first, second, and third order are compared theoretically with the TFD function as a function of temperature and of $|\bar{X}|$. The inversion phenomenon of the scattering given by the Laval functions permitted the determination, by cooling the crystal, of whether the continuous scattering regions can be expressed, in spite of their complexity, by a significant contribution of the scattering of the Laval first, second, and third orders. (tr-auth)

6063 STUDY OF THE ABNORMAL TRANSMISSION OF X RAYS IN SILICON CRYSTALS. I. CASE OF PERFECT CRYSTALS. A. Authier (Laboratoire de Minéralogie-Cristallographie, Paris). Bull. Soc. Franc. Mineral. Crist., 84: 51-89(Jan.-Mar. 1961). (In French)

The bases of the dynamic theory of x-ray diffraction are recalled by using a geometric method for the calculation of the position of the characteristic points and of the wave amplitude in the crystal, and the energy path is calculated in the case of an infinite and plane incident wave. The energy distribution on the exit face of the crystal was verified quantitatively in the case of a limited wave. It is shown that it is possible, by using the phenomenon of multiple refraction and a fine window, to establish an almost unequivocal relationship between the incidence angle and the wave length of the rays of a bundle. This correlation permits the separation of the wave fields in the second crystal of a two-crystal montage to be shown photographically and the intrinsic profiles of the reflection rays to be packed very closely. The energy distribution on the exit face of the second crystal was calculated and verified in absolute values. The profiles of the reflection rays and the integrated intensities were studied experimentally as a function of the sample thickness. A double transmission spectrograph was used for these studies and absolute measurements were made using an ionization chamber. (tr-auth)

6064 STUDY OF THE ABNORMAL TRANSMISSION OF X RAYS IN SILICON CRYSTALS. II. APPLICATION TO IMPERFECT CRYSTALS. A. Authier (Laboratoire de Minéralogie-Cristallographie, Paris). Bull. Soc. Franc. Mineral. Crist., 84: 115-27(Apr.-June 1961). (In French)

It is shown how the dislocation images obtained using the abnormal transmission of x rays in crystals such that $\mu d \sim 6$ can be used to reconstruct in space a dislocation line. The dislocation images are presented in the form of a double line, black and white, if the fault is located on the exit face of the crystal and in the form of a triple line, black-white-black, if the dislocation is at the interior of the crystal. A theoretical model is described that permits the image profiles to be calculated, the experimentally observed characteristics to be interpreted, and the order of magnitude of the deformation field to be obtained at a great distance from a dislocation. (tr-auth)

6065 REVERSE ISOTOPE EFFECT OF CARBON-14 IN THE BECKMANN REARRANGEMENT. Y. Yukawa and M. Kawakami (Osaka Univ.). Chem. Ind. (London), 1401-2 (Sept. 2, 1961).

The kinetic isotope effect of C^{14} in the Beckmann rearrangement was examined to elucidate the mechanism of the reaction. The kinetic isotope effect was calculated from the fraction of oxime unreacted and the ratio of specific activity of oxime in the course of the reaction to the initial specific activity of the oxime. Unreacted oxime was converted to its 2,4-dinitrophenylhydrazone and oxidized to CO_2. No effect was observed in the reaction of carbonyl-C^{14}-labeled phenylacetoxime in sulfuric acid but a significant reverse isotope effect ($\underline{K}^{14}/\underline{K}^{12} = 1.05$) was observed in the case of methylene-C^{14}-labeled phenylacetoxime. The reverse isotope effect is undoubtedly caused by the zero point energy effect between the ground state and the more firmly bound transition state. A more pronounced effect was observed in the migration of a phenyl group. This was shown in the rearrangement of acetophenoxime labeled with C^{14} at phenyl-1-C. The kinetic isotope effect was reverse, $\underline{K}^{14}/\underline{K}^{12} = 1.12$, whereas no effect was observed in the case of carbonyl-C^{14}-labeled acetophenoxime. The absence of a kinetic isotope effect in the reaction of carbonyl-labeled compounds suggests that loosening of the bond between the migrating group and the carbonyl carbon is not involved in the transition state. These results favor a mechanism in which the migrating group participates in the fission of the N—O bond, while the bond between the migrating group and the N atom is forming in the transition state. When the activated complex is stabilized as in acetophenoxime, the nonclassical ion would be formed and the reverse isotope effect may be more significant in such cases. An alternative explanation may be the difference of the transmission coefficient, but the lack of isotope effects in carbonyl-carbon labeled compounds suggests that the difference may be negligible. (H.H.D.)

6066 ISOTOPE SHIFT IN THE NUCLEAR MAGNETIC RESONANCE SPECTRA OF H_2 AND HD. D. F. Evans (Imperial Coll. of Science and Tech., London). Chem. Ind. (London), 1960(Dec. 2, 1961).

The chemical shift between H_2 and HD was measured on a mixture of HD and excess H_2 at ~140 atm. dissolved in CCl_4 and also a perfluorinated cyclic ether $(CF_2)_4O$. The middle line of the HD triplet was partly obscured by the H_2 line; therefore the mean position of the 2 outer lines was used. In both solvents, $\sigma(HD)-\sigma(H_2)$ was found to be 0.036 ± 0.002 ppm, in fair agreement with the theoretical value of 0.025 ppm. The discrepancy may be partly due to a smaller contribution from nucleus-electron interactions. J_{HD} was found to be 42.9 ± 0.2 (CCl_4 solution), 43.2 ± 0.2, and 43.3 ± 0.3 cps (gas at 140 atm). The values are in good agreement

with those previously reported for gaseous HD (42.7 ± 0.7 cps). The τ values for H_2 were 5.35 (CCl_4 solution) and 5.49 ($(CF_2)_8O$ solution). (H.H.D.)

6067 DEUTERIUM EXCHANGE BY THE DIAZOACETYL GROUP. H. A. Morrison and P. Yates (Harvard Univ., Cambridge). Chem. Ind. (London), 931-2(May 26, 1962).

Deuterium exchange was used to investigate the relative importance of proton abstraction and terminal addition mechanisms in base-catalyzed reactions of α-diazo ketones of the type $R \cdot CO \cdot CHN_2$. The exchange reaction of 2-diazo-2′,4′,6′-trimethylacetophenone was studied because of its relative stability in alkaline solution. The compound in ethanol-d was treated with Na methoxide for 1.5 hr and the mixture was added to D_2O. The product of the reaction, precipitated from pentane, was shown by its nuclear magnetic spectrum to be 2-diazo-2′,4′,6′-trimethylacetophenone-2d. The infrared spectrum showed the C-D stretching bond at 4.40 μ, and that the product reverted to the starting compound after standing in methanol. To establish the mechanism of D exchange by the diazo-acetyl group, the relative rates of exchange at 25° in methanol-d were studied in the presence of catalytic amounts of nucleophilic reagents. The times for 50% exchange ($t_{½}$) of 0.29 mmole diazo ketone in 0.25 ml methanol-d in the presence of 0.007 mmole KI, KBr, and LiCl were 1.5, 5, and 11 hr, respectively, compared with 14 hr in the absence of salts. In the presence of $LiClO_4$, $t_{½}$ was 13 hr, showing that the salt effect alone cannot account for halide-induced acceleration of the exchange. D exchange was complete within 5 min in the presence of Na methoxide, Na azide, or Na acetate. Since catalytic efficiency of the halides increases with increasing polarization and is inversely related to the basicity of the ion, which indicates that with halides the exchange occurs mainly by the terminal addition route: $RCOCHN_2 + B^- \rightleftharpoons [RCOCHN_2B]^-$. The rate of this addition reaction should be more sensitive to the polarizability than to the basicity of the addend. However, the faster rates with the basic catalysts (methoxide, azide, and acetate ions), indicates that the proton abstraction route predominates in this case: $RCOHN_2 + B^- \rightleftharpoons [RCOCN_2]^- + BH$. (H.H.D.)

6068 THE OXYTELLURIDES OF THE RARE EARTHS ELEMENTS. Marie-Paule Pardo, Jean Flahaut, and Louis Domange (Faculté de Pharmacie, Paris). Compt. Rend., 255: 937-9(July 30, 1962). (In French)

A study was made of a new series of compounds with the general formula L_2O_2Te in which L is one of the following rare earths – La, Ce, Pr, Nd, Sm, Eu, Gd, and Dy. All these compounds have the same quadratic structure. A description is given of their preparation and the principal chemical properties. (tr-auth)

6069 SEPARATION OF RARE EARTH ELEMENTS BY DISTILLATION OF THEIR OXIDES IN A SOLAR FURNACE. THE CASE OF LANTHANUM–CERIUM MIXTURES. Félix Trombe and Marc Foëx. Compt. Rend., 255: 1447-9 (Sept. 17, 1962). (In French)

The distillation of CeO_2 and its separation from La_2O_3 in a solar furnace were studied systematically. The coefficients of separation were determined and shown graphically as a function of the CeO_2 concentration in the primary substance. The separation velocity increases when the initial CeO_2 concentration is high. The La traces are retained in the fused state. Excess La_2O_3 retards the distillation of the CeO_2. (J.S.R.)

6070 SEPARATION OF NEODYMIUM AND PRASEODYMIUM BY DISTILLATION OF THEIR OXIDES AT HIGH TEMPERATURE IN A SOLAR FURNACE. Félix Trombe and Marc Foëx. Compt. Rend., 255: 1516-18(Sept. 24, 1962). (In French)

The separation of Nd and Pr by high-temperature distillation of their oxides was studied. The distillation velocity of praseodymium oxide was first determined. It was determined that the coefficient of separation of the oxides of Pr and Nd was 8 in an oxidizing medium and only 4 in a reducing medium. The compositions of the distilled phases are shown as a function of the initial composition of the mixtures. The separation coefficient was also determined for various proportions of oxides in the treated product, and it was shown to be almost constant. (J.S.R.)

6071 KINETIC TRACER INVESTIGATIONS ON COMPETING REACTIONS INVOLVING CERTAIN RADICALS. M. B. Neiman, V. Ya. Efremov, and N. K. Serdyuk (Inst. of Chemical Physics, Moscow). Intern. J. Appl. Radiation Isotopes, 13: 295-303(June 1962). (In English)

Certain competing reactions involving $CH_3\dot{C}O$, $\dot{C}H_3$, $CH_3OO\cdot$ and $\dot{H}$ radicals were studied using the kinetic tracer method. It was shown that for the reaction $CH_3\dot{C}O + O_2$ the activation energy is 8 kcal/mole and the pre-exponential factor is 10^{-10} cm^3 sec^{-1}. The methyl radicals in a mixture of C_3H_8 and O_2 at 315°C yield mainly oxygen-containing products and only small amounts of methane. The $CH_3OO\cdot$ radicals in the same mixture yield formaldehyde and methanol at an approximately equal probability. Rate constants for reactions $H + C_2H_4 \rightarrow C_2H_5$ and $H + C_3H_8 \rightarrow C_3H_7$ at 554°C are approximately the same. (auth)

6072 REPORT OF THE INTERNATIONAL COMMISSION ON ATOMIC WEIGHTS (1961). A. E. Cameron and Edward Wichers. J. Am. Chem. Soc., 84: 4175-97(Nov. 20, 1962).

The atomic weights of the elements, based on C^{12} with assigned mass 12, are tabulated. An element-by-element review is alos presented. 208 references are given. (P.C.H.)

6073 THE NATURE OF THE SLOWLY EXCHANGING PROTONS OF RIBONUCLEASE. Arnold Wishnia and Martin Saunders (Dartmouth Medical School, Hanover, N. H. and Yale Univ., New Haven). J. Am. Chem. Soc., 84: 4235-9 (Nov. 20, 1962).

The nuclear magnetic resonance spectra of ribonuclease in D_2O solutions between pD 2.8 and 4.5 showed exchange of NH protons with time. 24 ± 5 protons exchanged much more slowly than the others. Guanidinated ribonuclease was shown to contain 54 ± 7 hydrogens exchanging at a comparable rate. When both proteins were heated to 72° exchange of all the NH protons was noted. It was suggested that the very slowly exchanging protons are attached to the guanidinium groups of both proteins. (auth)

6074 COMPLEX ION FORMATION BETWEEN CATIONS. SPECTRA AND IDENTIFICATION OF A Np(V)–Cr(III) COMPELX. James C. Sullivan (Argonne National Lab., Ill.). J. Am. Chem. Soc., 84: 4256-9(Nov. 20, 1962).

A complex ion $Cr(H_2O)_5^{3+}(NpO_2^+)$ was separated by use of an inorganic ion exchanger. Identity of the species was determined by the analytical ratio of Np/Cr in solution. Spectra are presented. Specific rate for decomposition of the complex is $(2.32 \pm 0.08) \times 10^{-6}$ sec^{-1} at 25° in 1.0 M $HClO_4$. From spectrophotometric observations the relative strength of interaction between Np(V) and M(III) perchlorates in 2.0 M $HClO_4$ is Fe > In > Sc > Ga > Al. (auth)

6075 THEORY OF ELECTRONIC ENERGY RELAXATION IN THE SOLID PHASE. G. W. Robinson and R. P. Frosch (California Inst. of Tech., Pasadena). J. Chem. Phys., 37: 1962-73(Nov. 1, 1962).

A theory of electronic energy relaxation in the solid

phase is presented. The physical limit where the electronic transition is slow compared with vibrational relaxation is shown to be a well-defined mathematical limit in the theory. In the other limit, where the electronic transition is rapid compared with the vibrational relaxation time, vibrational relaxation plays the dominant role in the over-all relaxation process. The result derived from a continuum model for the final states is justified only in the first limit and only then providing the assumption of a large number of final states is physically justified. Two different models were used to illustrate the source of the mathematical limitations and the range of applicability of the theory. The models removed the ambiguities which arise from the normalization of continuum states in the continuum model. (auth)

6076 USE OF WEAK PERTURBING RADIO-FREQUENCY FIELDS IN NUCLEAR MAGNETIC DOUBLE RESONANCE. R. Freeman and W. A. Anderson (Varian Associates, Palo Alto, Calif.). J. Chem. Phys., 37: 2053-73(Nov. 1, 1962).

A theory is developed to explain high-resolution nuclear magnetic resonance spectra observed in the presence of a second weak rf field at ω_2. When ω_2 is set on a nondegenerate transition frequency and the rest of the spectrum recorded by sweeping the frequency of the investigating rf field, any transitions that have an energy level in common with the perturbed transition will be split into doublets. If magnetic field inhomogeneities exceed the natural linewidth, the line profile of the doublets gives information about the ordering of the three energy levels involved. Good agreement with the theory was obtained in experiments on two-spin and three-spin proton systems where the energy-level diagram was already known. The method was used to establish the ordering of the energy levels of the ABC system of protons in methyltrivinylsilane and the analysis was completed by two independent methods. Some of the special effects which arise when double-resonance spectra are recorded by sweeping the magnetic field were examined and are discussed. (auth)

6077 PRELIMINARY VALUES OF SOME MOLECULAR CONSTANTS OF LITHIUM HYDRIDE. Lennard Wharton, L. Peter Gold, and William Klemperer (Harvard Univ., Cambridge, Mass.). J. Chem. Phys., 37: 2149-50 (Nov. 1, 1962).

The dipole moment, quadrupole coupling kc, spin-rotation kc, and rotational magnetic moment of Li^7H and Li^7D, derived from an analysis of the spectra, are reported. The constants come from the analysis of the transition $J = 1$, $m_J = 0 \rightarrow J = 1$, $|m_J| = 1$ in a relatively strong electric field. (P.C.H.)

6078 DIRECT MEASUREMENT OF ADSORPTION OF RADIOLABELED COMPOUNDS. Donald C. Walker and Herman E. Ries, Jr. (American Oil Co., Whiting, Ind.). J. Colloid Sci., 17: 789-800(Dec. 1962).

A new apparatus and technique permit direct and continuous measurement of radiolabeled compounds adsorbed from solution onto clean solid surfaces. Thin films of metals are deposited under high vacuum onto the surface of a mica window and contacted with the solution containing the radiolabeled compound; adsorption is measured by a counter tube below the window. Clean vapor-deposited films can thus be prepared and maintained; surface reproducibility is apparently good. Adsorption, desorption, diffusion, and many complex surface phenomena related to catalysis, corrosion, lubrication, and detergency can be studied. Preliminary studies were made on the adsorption of radiostearic acid from a dilute n-hexadecane solution onto mica and 100-A films of iron, copper, and gold exposed to dry helium and dry air. Adsorption was consistent with the relative reactivity of the bulk materials. Mica did not adsorb stearic acid. Iron adsorbed one monolayer; the initial adsorption in air was faster than in helium perhaps because of an oxide film. Copper initially adsorbed about 0.8 monolayer in either atmosphere and then desorbed to 0.3 monolayer apparently because of formation of copper stearate. Gold in helium adsorbed about half a monolayer, but the adsorption decreased to zero after 25 hours; in air, the same amount was adsorbed without subsequent desorption. (auth)

6079 THE INTERACTION OF MYRISTIC ACID MONOLAYERS WITH THORIUM AND LANTHANUM SOLUTIONS. M. B. Abramson and R. H. Ottewill (Department of Colloid Science, Cambridge, Eng.). J. Colloid Sci., 17: 883-94 (Dec. 1962).

The hydrolysis of thorium and lanthanum ions in solution, although of general chemical interest, is of particular importance in colloid chemistry in view of the importance of these ions in studies on the flocculation of lyophobic colloids. The transition surface pressure of myristic acid monolayers forms a very sensitive detector of ion hydrolysis in the lower pH regions. Moreover, hydrolysis can be detected in solutions as dilute as 10^{-6} M in the absence of added electrolyte. The interaction of myristic acid monolayers with thorium and lanthanum is used as a method of investigating the hydrolysis of these ions. (auth)

6080 TRANSPORT NUMBERS OF SOME PURE FUSED NITRATES AND NITRITES. F. R. Duke and George Victor (Ames Lab., Ames, Iowa). J. Electrochem. Soc., 110: 91 (Jan. 1963). (IS-479)

The transport numbers of cations were determined for the following fused nitrates and nitrites: $RbNO_3$, 0.59 ± 0.04; $CsNO_3$, 0.59 ± 0.07; $TlNO_3$, 0.60 ± 0.05; KNO_2, 0.62 ± 0.06; $NaNO_2$, 0.75 ± 0.10; KNO_3, 0.59 ± 0.02; and $NaNO_3$, 0.68 ± 0.05. The transport numbers of NH_4NO_3 were found to vary with the time of the run. (D.L.C.)

6081 ABSORPTION SPECTRA OF URANIUM (VI) COMPLEXES IN SOLUTIONS. Z. Libuś (Inst. of Physical Chemistry, Polish Academy of Sciences, Warsaw). J. Inorg. Nucl. Chem., 24: 619-31(Nov. 1962).

Absorption spectra of the complex $[UO_2(NO_3)_2(TBP)_2]$ in various organic solvent solutions and that of $[UO_2(CH_3COO)_3]^-$ in water solutions of various acetates were determined. The stepwise formation of uranyl complexes was followed spectrophotometrically. Characteristic features of spectral effects accompanying solvent exchange, outer-sphere association, and ligand exchange involving the uranyl ion are discussed. Conclusions were drawn from the spectral effects observed regarding the interpretation of the absorption band of the uranyl ion between 370 and 480 mμ. (auth)

6082 PREPARATION OF ANHYDROUS LANTHANON ACETATES BY DESOLVATION. J. R. Witt and E. I. Onstott (Los Alamos Scientific Lab., N. Mex.). J. Inorg. Nucl. Chem., 24: 637-9(Nov. 1962).

Anhydrous acetates of Y, La, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu were prepared by desolvation of the acetates in vacuum at 150°C after dissolution of the oxides in 50% acetic acid and evaporation to dryness. Acetates of Pr and Nd did not reach constant composition before decomposition occurred. A hemihydrate of Sm acetate was formed which decomposed at temperatures above 150°C without converting to the anhydrous acetate. Hemihydrates of Tb and Ho were formed at about 75°C. (auth)

6083 THE VAPOUR-PRESSURE AND TRANSITION POINTS OF TcF_6. H. Selig and J. G. Malm (Argonne National Lab., Ill.). J. Inorg. Nucl. Chem., 24: 641-4(Nov. 1962). (TID-15274)

The vapor-pressure and transition points of TcF_6 were measured. The vapor-pressure is represented by the following equations: Solid I (−16.32 to −5.3°) $\log_{10}p = -(3564.8/T) - 10.787 \log_{10}T + 41.1252$; Solid II (−5.3 to 37.4°) $\log_{10}p = -(2178.0/T) - 2.295 \log_{10}T + 15.33427$; Liquid (37.4−51.67°) $\log_{10}p = -(2404.9/T) - 5.8036 \log_{10}T + 24.8087$. TcF_6 undergoes a solid−solid transition at −4.54° and melts at 37.4°. (auth)

6084 ISOTOPIC EXCHANGE IN THE COBALTOUS-COBALTIC SYSTEM IN PERCHLORIC ACID. II. HEATS AND ENTROPIES OF EXCHANGE. J. Shankar and B. C. de Souza (Atomic Energy Establishment, Trombay, India). J. Inorg. Nucl. Chem., 24: 693-7(Nov. 1962).

Thermodynamic data were evaluated for the two paths through which exchange takes place in the cobaltous−cobaltic aquo system in perchloric acid. For the acid-independent path $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$ were found to be 12.6 ± 0.5 kcal $mole^{-1}$, and −14 ± 2 eu respectively, while the values for the acid-dependent path were 11.6 ± 2.5 kcal $mole^{-1}$ and −7 ± 5 eu. The temperature was varied from 0 to 20°C while the ionic strength was maintained at 1.0 throughout. (auth)

6085 SPECTROSCOPIC STUDIES OF RARE EARTH CHELATES. G. A. Crosby, R. E. Whan, and J. J. Freeman (Univ. of New Mexico, Albuquerque). J. Phys. Chem., 66: 2493-9(Dec. 1962).

Intramolecular energy transfer in rare earth chelates is discussed and the role of the triplet states of the complexes in this type of energy migration is reviewed briefly. A spectroscopic study of the chelates of La^{3+}, Pr^{3+}, Sm^{3+}, Eu^{3+}, and Gd^{3+} with o-hydroxybenzophenone is reported. Luminescence spectra (at 77°K) of these compounds are presented and the triplet state energies of the chelates and their dissociation products were determined utilizing energy transfer as an aid in interpreting the complicated luminescences observed. Very weak "line" emission from the coördinated Pr^{3+} ion is reported and selective excitation of the $^1D_2$, $^3P_0$, and $^3P_1$ resonance levels of this ion via intramolecular energy transfer is demonstrated. (auth)

6086 EFFECTS OF NEUTRON AND ULTRAVIOLET IRRADIATION ON THE CATALYTIC ACTIVITY OF MAGNESIUM OXIDE. Jack H. Lunsford and Thomas W. Leland, Jr. (Rice Univ., Houston, Tex.). J. Phys. Chem., 66: 2591-7(Dec. 1962).

A technique was developed for changing the electronic and defect structure of magnesium oxide catalysts. Relatively small doses of ultraviolet and neutron irradiation were found to enhance the catalytic activity of MgO for the reaction $H_2 + D_2 \rightleftharpoons 2HD$. The enhancement by radiation depends on the extent of degassing of the catalyst prior to irradiation; the less active samples are more sensitive to irradiation. For samples activated at 291°, ultraviolet-irradiated MgO reaches a precise saturation value of catalytic activity, while neutron-irradiated samples continue to increase in activity upon further irradiation. Both types of irradiation produce a large initial increase in activity. Changes in activation energy depend on the thermal activation and type of irradiation. The activation energy either increases or remains unchanged for neutron irradiation, while ultraviolet irradiation does not cause a change. For this system, a simple model based upon Fe^{3+} as the irradiation-induced site was developed. Other possibilities are discussed. It was shown that most of the activity change must be attributed to changes in the electronic structure of the crystal rather than in the number of lattice imperfections. (auth)

6087 THE REACTIONS OF RECOIL TRITIUM ATOMS WITH CYCLOPROPANE PLATINOUS CHLORIDE. Edward K. C. Lee and F. S. Rowland (Univ. of Kansas, Lawrence). J. Phys. Chem., 66: 2622-5(Dec. 1962).

Recoil tritium atoms react with cyclopropane platinous chloride to produce labeled cyclopropane and propylene in the ratio of approximately 1 to 3. The yield of propylene is higher than for reactions with the free molecule in the gas phase and indicates an influence on the reaction course from the strong binding of the cyclopropane molecule in the complex. (auth)

6088 FREEZING POINT DEPRESSIONS IN SODIUM FLUORIDE. II. EFFECT OF TETRAVALENT FLUORIDES. Stanley Cantor and Terry S. Carlton (Oak Ridge National Lab., Tenn.). J. Phys. Chem., 66: 2711-13(Dec. 1962).

The freezing point depressions in NaF caused by ZrF_4, HfF_4, ThF_4, and UF_4 were measured and the excess partial molal free energies of solution of NaF calculated therefrom. All the deviations from ideal solution behavior were negative and greater than these for alkaline earth fluoride solutes. It was found that the deviations increase with the tetravalent cation radius, and this fact is ascribed to steric effects. The freezing point of NaF containing two solutes was also studied, and a synergistic effect was found for solute concentrations of 15 mole %. (D.L.C.)

6089 CATHODOLUMINESCENCE OF BERYLLIUM OXIDE AND ITS RELATED COMPOUNDS. Yoichi Uchida, Eiichi Matsui, and Masuo Nakagawa (Kyoto Univ.). J. Phys. Soc. Japan, 17: 1904-5(Dec. 1962). (In English)

The cathodoluminescence spectra of BeO, CaO, and MgO are measured at 90 and 320°K. In each of these compounds, two series of oxygen-sensitive emission bands are found that are enhanced at the low temperature. (T.F.H.)

6090 COMPARISON OF THE CHEMISTRY OF CIS- AND TRANS-URANIDES WITH THAT OF LANTHANIDES AND OF TRANSITION METALS. M. Haissinsky (Curie Lab., Paris). Magy. Tud. Akad. Kem. Tud. Oszt. Kozlemen., 18: 395-411(1962).

The existence of the actinide series was rejected and the elements following actinium were divided into two sharply differing groups named cis- and trans-uranides. According to this classification the elements belonging to the first group are the homologues of the family of transition metals while the second group consists of the homologues of the second half of the lanthanide series. The separation is based on valency observations, electrochemical properties, tendency toward hydrolysis, and complex formation and analogies observed in the fields of atomic and ion dimensions. The elements of the 7th Period also differ from the lanthanides from the point of view of electronic structure. On the basis of available information it seems justified to divide the 5f elements (z = 92-103) into two groups, the uranides and the curides. An extensive bibliography and a history of the chemistry of the elements discussed are also included. (OTS)

6091 A FEW REMARKS ON M. HAISSINSKY'S ARTICLE: "COMPARISON OF THE CHEMISTRY OF CIS- AND TRANS-URANIDES WITH THAT OF LANTHANIDES AND OF TRANSITION METALS." Zoltan Szabo and Bela Lakatos (Szeged Univ. of Science). Magy. Tud. Akad. Kem. Tud. Oszt. Kozlemen., 18: 413-18(1962).

The fact that Haissinsky discussed only the chemical properties of the elements and neglected their physical properties was found to be peculiar. It is felt that the

valency states do not offer a reliable basis for a periodic classification, and the physical properties actually present an argument against the previous concept. Calculations that are constantly being improved unequivocally point toward the existence of the actinide series. It is also believed that the attempt to establish a cis- and trans-uranide class in the elaboration of a principle underlying the formation of main groups in the periodic system is not warranted. (P.C.H.)

6092 FLUORESCENCE CENTRES IN ZnS. W. Van Gool. Thesis, Amsterdam, Universiteit, 1961. 122p. Philips Res. Rept., Suppl., No. [3], 122p. (1961). (In English)

An investigation is made of the fluorescence properties of ZnS, CdS, and ZnS–CdS mixtures. The chemistry of defects in these crystals is studied. The preparation and physical properties of the crystals are also examined. The effects of additions of atomic and oxide activators and coactivators on the fluorescence are surveyed. (T.F.H.)

6093 MASS SPECTROMETRIC DETERMINATION OF THE HEAT OF VAPORIZATION OF SOME SOLID ELEMENTS. T. P. J. H. Babeliowsky (FOM-Laboratorium voor Massascheiding, Amsterdam). Physica, 28: 1160-9 (Nov. 1962). (In English)

Vaporization of wires made of several elements is studied as a function of temperature. The vapor is ionized in the ion source of a mass spectrometer (ion intensity = I). The temperature of the wire is determined using a pyrometer. Log [IT] as a function of 1/T gives the heat of vaporization. Correction for the spectral emissivity of the wires must be made. (auth)

6094 THE VISCOSITY OF LIQUID DEUTEROMETHANE. J. P. Boon and G. Thomaes (Université Libre, Brussels). Physica, 28: 1197-8(Nov. 1962). (In English)

The kinematic viscosity of CD_4 is measured and compared with that of CH_4 at 91 to 113°K. The CD_4 contains 2.7% CHD_3. The experimental results are also compared with theoretical predictions. (T.F.H.)

6095 CORRELATION OF DISSOCIATION ENERGIES OF GASEOUS MOLECULES AND OF HEATS OF VAPORIZATION OF SOLIDS. PART I. HOMONUCLEAR DIATOMIC MOLECULES. G. Verhaegen, F. E. Stafford, P. Goldfinger, and M. Ackerman (Université Libre, Brussels). Trans. Faraday Soc., 58: 1926-38(Oct, 1962).

Two correlations are proposed. The first correlation classifies the forty odd known homonuclear diatomic molecules according to the ratio $\alpha = \Delta H_0^0(\text{vap M})/D_0^0(M_2)$ (heat of vaporization of an atom/dissociation energy of the diatomic molecule). Values of α = 0.5 to 1, 1.2 to 2.5 and >5 correspond to three categories each consisting of several whole groups of elements. The significance of this classification is discussed qualitatively. The second correlation shows that $\Delta H_0^0(\text{vap M})$ can be closely represented by $\Lambda - B\Sigma_i\epsilon_i(M)$. $\Sigma_i\epsilon_i(M)$ is the energy necessary to excite the atoms to a promoted configuration composed of equal contributions of a well-defined set of low lying electronic states of the free atom. Λ and B are empirical parameters. One set of electronic states is taken for Ca to Ni, Sr to Pd, and Ba to Pt with $B = \frac{1}{2}$ and Λ = 178, 206, 250 kcal/g atom, respectively; another set of electronic levels and Λ = 131 kcal and $B = \frac{1}{4}$ represent $\Delta H_0^0(\text{vap M})$ for Ni, Cu, Zn, Pd, Ag, Cd, Pt, Au, and Hg. Using the first classification, the experimental conditions are estimated for observation of the yet unknown homonuclear diatomic molecules of the transition elements. For this purpose a self-consistent set of free energy functions was calculated. (auth)

6096 IONIC HYDRATION. A. J. Rutgers and Yolande Hendrikx. Trans. Faraday Soc., 58: 2184-91(Nov. 1962).

The transfer of H_2O to D_2O and D_2O to H_2O, was measured in two adjacent compartments of an apparatus filled with an electrolyte solution through which d-c was passed. The influence of diffusion and exchange with the medium was eliminated; linear relations between the hydration numbers of the relevant ions were obtained. In a second apparatus the sum of the cationic and anionic hydration numbers of one electrolyte was determined. Combination of the results with the former set of linear relations gave $h_{Cl^-} = 5$ (from LiCl and NaCl). Ionic hydration numbers were obtained for: Li^+, Na^+, K^+, Cs^+; Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cu^{2+}, Zn^{2+}, Cd^{2+}; and Cl^-, Br^-, F^-, acetate, and sulfate. (auth)

6097 CHEMISTRY OF Zr SALTS IN AQUEOUS SOLUTIONS (ON THE EXISTENCE OF ZIRCONYL ION). A. S. Solov'ev and Z. N. Tsvetkova. Usp. Khim., 31: 1394-1416 (Nov. 1962). (In Russian)

A review is given of available data on the chemistry of zirconium in aqueous solutions and on the improbability of zirconyl theory. The properties and complexing of Zr in aqueous and acid salt solutions and preparative chemistry of Zr compounds are analyzed. 161 references are included. (R.V.J.)

6098 STUDY OF HYDROGEN ISOTOPE EXCHANGE, PARA-HYDROGEN CONVERSION, AND OXYHYDROGEN GAS COMBUSTION WITH AQUEOUS SUSPENSIONS OF NOBLE METAL-CHARCOAL CATALYSTS. U. Schindewolf, M. Kenawy, and E. G. Mahadevan (Technische Hochschule, Karlsruhe, Ger.). Z. Elektrochem., 66: 406-12(1962). (In German)

The isotope exchange between hydrogen and water, the para-hydrogen conversion and the combustion of oxyhydrogen gas at pressures below 1 atm were examined with aqueous suspensions of palladium and platinum charcoal catalysts. The results can be explained by the assumption that the three reactions are initiated by catalytic activation of hydrogen, the chemisorption being proportional to pressure. Dissociation of hydrogen into atoms seemed necessary only for the isotope exchange reaction. (auth)

6099 CONCERNING THE BEHAVIOR OF THE 4f ELECTRONS IN SOME METALS OF THE RARE EARTHS UNDER THE INFLUENCE OF LIGHT. Armin Tannhaeuser (Technische Hochschule, Munich). Z. Physik, 170: 526-32 (1962). (In German)

The visible spectra of the rare-earth metals Pr, Nd, Sm, and Er were examined to determine whether they contain absorption lines due to transitions within the 4f-shell. Optical measurements were made on vacuum evaporated transparent films at 90°K. No spectral lines were found. It was shown by complete oxidation of the metal films that eventual absorption lines of the metals must be at least 3.5 times weaker or broader than those of the oxides. The absence of the lines is suggested to be caused by the conduction electrons. As the crystalline field is largely screened by the conduction electrons the oscillator strength of the electric dipole radiation is rigorously reduced. Lines may be broadened by exchange of excitation between 4f-electrons and conduction electrons. (auth)

6100 PREPARATION OF CERIUM NITRIDES. G. V. Samsonov and M. D. Lyutaya (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Zh. Prikl. Khim., 35: 2359-62(Nov. 1962). (In Russian)

Production of CeN by metallic cerium nitridation using nitrogen and ammonia was studied, and it is shown that a stoichiometric composition of cerium nitride was achieved

with nitrogen at 800°C and with ammonia at 500°C and above. In nitrogen gas opaque nitride films, that disappear only at the melting point, form on metallic particles, while in ammonium nitridation the initially formed cerium hydrides loosen the metal and prevent the formation of nitride films, resulting in active nitration at low temperatures (<200°). (R.V.J.)

6101 SOLID SOLUTIONS OF LANTHANUM ORTHOSILICATES IN A DI-CALCIUM SILICATE. N. A. Torpov and N. F. Fedorov. Zh. Prikl. Khim., 35: 2548-50(Nov. 1962). (In Russian)

Preparation and properties of $CaO-La_2O_3-SiO_2$ orthosilicates are discussed. A limited series of solid solutions based on calcium orthosilicates was observed in lanthanum orthosilicate–calcium silicate systems. Various high-temperature di-calcium silicates are stabilized with transformations rates exceeding the annealing rate. (R.V.J.)

6102 ISOTOPIC EXCHANGE OF POTASSIUM IN AN ILLITE UNDER EQUILIBRIUM CONDITIONS. M. E. Sumner and G. H. Bolt (Landbowhegeschool, Wageningen, Netherlands). IAEA Preprint SM-32/51. 14p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The kinetics of potassium exchange in an illite was studied using K^{42}. In contrast to existing chemical extraction procedures, K^{42} exchange allows the investigation of the exchange to be made under equilibrium conditions. Up to the present time few attempts have been made in this direction, because of the relatively low specific activity of the available K^{42} isotope (about 10 mC per g of K). In combination with the fact that the equilibrium concentration of K in the soil solution is usually less than about 10^{-4} molar, this implies that the observed count rate at the outset of the experiment is of the order of 1000 cpm per ml solution, and thus about 10 cpm per ml after three days of equilibration. If the rate of exchange is to be studied over longer periods, the use of low-background counting equipment becomes imperative. Experiments were carried out with a number of samples from the same illite, varying in percentage K-saturation and pretreatment. The results indicate that after a very fast initial exchange (presumably K ions present in surface positions) the subsequent exchange is very slow, and in a number of cases nondetectable within a period of about 8 days. (auth)

6103 THE HYDROGEN ISOTOPES IN THE GASEOUS AND LIQUID STATES. Henricus Franciscus Petrus Knaap. Thesis, Leiden, Rijksuniversiteit, 1962. 64p.

The second virial coefficients are measured below 70°K for H_2, D_2, HD; for binary mixtures of these molecules; for binary mixtures of these molecules with He; and for ortho and para H_2 and D_2. The Lennard-Jones 6–12 potential parameters of H_2 and D_2 are calculated. The heats of mixing and the volume changes upon mixing are determined for several of the binary mixtures studied. (T.F.H.)

6104 THERMODYNAMICS OF NUCLEAR MATERIALS. Proceedings of the Symposium Held by the International Atomic Energy Agency in Vienna, 21–25 May 1962. (International Atomic Energy Agency, Vienna). Proceedings Series. Sept. 1962. 815p. (STI/PUB/58). $11.00; 66s; NF 44; DM 38.50(IAEA).

Forty-six papers are presented on research involving the thermodynamics of important nuclear materials. Particular emphasis is placed on the thermodynamics of actinides and vaporization processes. Separate abstracts were prepared for 7 papers; 39 papers were previously abstracted in NSA. (R.J.S.)

6105 THERMODYNAMICS OF THE ACTINIDES. B. B. Cunningham (Univ. of California, Berkeley). p.61-70 of "Thermodynamics of Nuclear Materials." Vienna, International Atomic Energy Agency, 1962. (UCRL-10176). (In English)

Recent work on the thermodynamic properties of the transplutonium elements is presented and discussed in relation to trends in thermodynamic properties of the actinide series. Accurate values are given for room temperature lattice parameters of two crystallographic forms, (face-centred cubic) fcc and dhcp (double-hexagonal close-packed), of americium metal and for the coefficients of thermal expansion between 157 and 878°K (dhcp) and 295 to 633°K (fcc). The melting point of the metal, and its magnetic susceptibility between 77 and 823°K are reported and the latter compared with theoretical values for the tripositive ion calculated from spectroscopic data. Similar data (crystallography, melting point and magnetic susceptibility) are given for metallic curium. A value for the heat of formation of americium monoxide is reported in conjunction with crystallographic data on the monoxide and mononitride. A revision is made in the current value for the heat of formation of AmO_2 and for the potential of the Am(III)-Am(IV) couple. The crystal structures and lattice parameters are reported for the trichloride, oxychloride and oxides of californium. (auth)

6106 SOME INCONSISTENCIES IN THE THERMODYNAMIC DATA FOR URANIUM COMPOUNDS. M. H. Rand (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.71-81 of "Thermodynamics of Nuclear Materials." Vienna, International Atomic Energy Agency, 1962. (In English)

Many of the thermodynamic data for uranium compounds are reliable and consistent, but a number of inconsistencies still remain. Some of these are discussed and suggestions made for work aimed at resolving them and for obtaining the more important thermochemical data still lacking for uranium compounds. Some of the problems reviewed are the vapor pressure of liquid uranium, the heats of formation and standard entropies of the aqueous ions, the reaction of graphite with uranium dioxide, the uranium-bismuth system, the uranium-oxygen system between $UO_{2.6}$ and UO_3, and the uranium-fluorine system between UF_4 and UF_6. (auth)

6107 NON-EQUILIBRIUM THERMODYNAMICS. I. Prigogine and R. Balescu (Université Libre, Brussels). p.85-91 of "Thermodynamics of Nuclear Materials." Vienna, International Atomic Energy Agency, 1962. (In English)

A short review of the methods of linear non-equilibrium thermodynamics is given. The Onsager reciprocity relations and their utility are discussed. The concept of entropy production and the variational principles associated with it are emphasized. An account is given of some recent work dealing with more complicated non-linear problems, such as non-Newtonian flow. It is shown that variational principles can be derived, which are valid in some very general cases. These principles can be used for an approximate computation of the properties of the stationary state, in situations where the exact solution of the equations of motion is hopelessly complicated. (auth)

6108 CALCULATION OF INTEGRAL AND PARTIAL THERMODYNAMIC FUNCTIONS FOR SOLIDS FROM DISSOCIATION–PRESSURE DATA. A. W. Searcy and D. J. Meschi (Univ. of California, Berkeley). p.131-42 of "Ther-

modynamics of Nuclear Materials." Vienna, International Atomic Energy Agency, 1962. (In English)

In calculations of thermodynamic data for solids from dissociation-pressure measurements, the assumption is commonly made that variations in solubilities with temperature are negligible. This assumption permits calculation only of integral free energies, heats, and entropies. For some solid phases the assumption is unnecessary and can be demonstrated to introduce significant error. Furthermore, for these phases, not only integral thermodynamic properties, but partial molal free energies, heats, and entropies can be calculated as functions of composition. Zirconium hydride and uranium hydride are two compounds which exhibit rather wide composition ranges at higher temperatures. In this work partial and integral thermodynamic properties have been calculated as functions of both temperature and composition for the elements in these hydride phases. From the dissociation pressure of hydrogen above these hydrides, the partial molal Gibb's free energies of the metals were obtained by integrations of the Gibbs-Duhem equation. The integral free energies were obtained as functions of composition from the partial molal free energies, and the integral enthalpies of the hydride phases were then calculated from the variations of these integral free energies with temperature. Entropies were obtained from the free energies and enthalpies at the desired temperatures and compositions. For any given composition, both the entropies and enthalpies of formation were found to be reasonably independent of the temperature, but they were influenced much more strongly by the composition. For each hydride phase, the minimum free energy of formation per gram atom shifts in composition as a function of temperature. When data were available over a sufficient temperature range, partial molal quantities were calculated from the variation of the corresponding integral quantity as a function of composition. It was possible for some conditions to check these quantities against values calculated independently from heat-capacity data. Good agreement was found. (auth)

6109 VAPORIZATION OF GADOLINIUM AND THORIUM DICARBIDES. D. D. Jackson, G. W. Barton, Jr., O. H. Krikorian, and R. S. Newbury (Univ. of California, Livermore). p.529-48 of "Thermodynamics of Nuclear Materials." Vienna, International Atomic Energy Agency, 1962. (UCRL-6701). (In English)

A mass spectrometric investigation was carried out on the vaporization processes and thermodynamics of vaporization of the solid dicarbides GdC_2 and ThC_2. Samples of these carbides were heated in graphite Knudsen cells and the vapors analyzed. The vapor species above GdC_2 (s) was found to be primarily Gd (g). GdC_2 (g) is a minor constituent, ranging from 1% of the gas at 2000°K to 5.8% at 2422°K. Above the ThC_2 (s), Th (g) and THC_2 (g) are of comparable magnitude. The enthalpy of sublimation of GdC_2 (s) to GdC_2 (g) is 143 kcal/mole; and to Gd (g), 101 kcal/mole. For ThC_2 (s), the enthalpy of sublimation to ThC_2 (g) is 213 kcal/mole and to Th (g) is 185 kcal/mole. ΔH°_{298} of formation of ThC_2 is calculated to be −48 kcal/mole. (auth)

6110 VAPORIZATION OF URANIUM AND URANIUM CARBIDES UNDER VACUUM. W. J. Deiss, H. Michaud, and G. Antelme (Centre d'Études Nucléaires, Grenoble, France). p.625-44 of "Thermodynamics of Nuclear Materials." Vienna, International Atomic Energy Agency, 1962. (In French)

The aim of the investigation was to obtain thin deposits as pure as possible of uranium, the monocarbide (UC) and dicarbide (UC_2). The advantages of the vaporization technique used (heating by electron bombardment) are explained. The vaporization of relatively pure uranium usually produces highly oxidized deposits, whereas the vaporization of uranium carbides gives practically oxide-free deposits. It is shown by a thermodynamic argument that, as a result of the formation of CO, the partial pressure of the oxygen is consistently lowered and that, under these conditions, the affinity of the uranium for oxygen is practically zero. The UC and UC_2 compounds were obtained without difficulty upon vaporizing uranium carbides. (auth)

6111 THERMODYNAMIC PROPERTIES OF ZIRCONIUM–OXYGEN, TITANIUM–OXYGEN AND HAFNIUM–OXYGEN ALLOYS. K. L. Komarek and M. Silver (New York Univ., New York). p.749-74 of "Thermodynamics of Nuclear Materials." Vienna, International Atomic Energy Agency, 1962. (In English)

Thermodynamic properties (partial molar free energies, enthalpies and entropies) of oxygen in solid titanium-oxygen, zirconium-oxygen, and hafnium-oxygen alloys have been determined from 0 to 30 at.% oxygen in the temperature range between 800 and 1000°C by equilibrating thin titanium, zirconium, and hafnium specimens with alkaline earth-metal vapors of known partial pressure and solid alkaline earth-metal oxides. The metal specimens were placed in a temperature gradient in an evacuated and closed tube in close physical contact with the oxide. The corresponding metal was kept at the lowest temperature on the bottom of the vertical tube, which was heated in a vacuum system until equilibration was achieved. In equilibrium, the specimens contained oxygen of the same partial pressure as that given by the known equilibrium between the earth alkaline metal and its oxide. By determining the weight increase of the specimens and their lattice parameters, the oxygen content was obtained and the thermodynamic properties of oxygen in these alloys were calculated. The partial molar free energy of oxygen in the range of solid solution in these alloys drops, first slowly, then exponentially to more negative values. In dilute solutions, the partial molar entropy of oxygen can be expressed by a statistical model assuming random distribution of oxygen atoms over the octahedral interstices in the hexagonal close-packed structure. The partial molar enthalpy of oxygen in dilute solutions is constant. The solubility of magnesium and calcium in zirconium, titanium, and hafnium is small and the activities of magnesium and calcium show strong positive deviations from Raoult's law. (auth)

Organic Chemistry

Refer also to abstracts 7122 and 7124.

6112 (AFOSR-2541) A NUCLEAR QUADRUPOLE RESONANCE AND X-RAY STUDY OF THE CRYSTAL STRUCTURE OF PENTACHLOROPHENOL. Tosio Sakurai (Pittsburgh, Univ. Crystallography Lab., and Pittsburgh. Univ. Radiation Lab.). [1962]. Contract AF49(638)-323. 38p. (AD-276140)

The crystal structure of pentachlorophenol was solved by the combined application of nuclear quadrupole resonance and x-ray diffraction. The molecules are linked by chains of hydrogen-bonds with a configuration similar to that in tetrachlorohydroquinone. The nuclear quadrupole resonance of one of the ortho chlorine atoms is specially affected by the intermolecular interaction. This interaction is attributed to the proton on the OH group of the adjacent molecule, and the existence of bifurcated hydrogen bonds with bond lengths O—H. .O = 2.97 A and O—H. .Cl = 3.28 A is inferred. During the phase determination, a pseudo solution was obtained, which was

unusually close to the true solution. The relation between these two solutions is discussed. (auth)

6113 (HW-SA-2414) RATES OF THERMAL POLYMERIZATION OF SEVERAL POLYPHENYL COMPOUNDS. D. R. de Halas and E. C. Gilbert (General Electric Co. Hanford Atomic Products Operation, Richland, Wash. and Oregon State Coll., Corvallis). Jan. 25, 1962. Contract AT(45-1)-1350. 12p.

The kinetics of polymerization of several polyphenyls and alky-substituted polyphenyls was investigated. In each case the polymerization rate was found to be proportional to the fraction of the remaining unpolymerized material. A reaction mechanism is proposed for the observed behavior. Rate constants, activation energies, and frequency factors were measured for each compound. (auth)

6114 (IS-434) STABILITY CONSTANTS AND INTRINSIC SOLUBILITY OF SEVERAL NICKEL(II)-vic-DIOXIME COMPLEXES. Charles V. Banks and Samuel Anderson (Ames Lab. Ames, Iowa). [Mar. 9, 1962]. Contract [W-7405-eng-82]. 20p.

An investigation was made to determine the stability constants for several Ni(II) vic-dioximes and to calculate their intrinsic solubility constants. Data and discussion concerning dimethylglyoxime, diethylglyoxime, di-n-propylglyoxime, ethylmethylglyoxime, 4-isoproplynioxime, nioxime, 4-methylnioxime, 3-methylnioxime, heptoxime, and Ni(II) complexes of these vic-dioximes are presented. (J.R.D.)

6115 (NYO-9868) POLARISATION OF THE LIGAND-FIELD SPECTRA OF SOME PLANAR CHELATE COMPLEXES. Walter R. Thorson and F. Albert Cotton (Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry). Mar. 15, 1962. Contract AT(30-1)-1965. 16p.

The polarizations observed in the ligand-field bands of bis-(acetyl-acetonato)copper(II) are explained on a basis, in which the order of energy levels is one that can be inferred from elementary ligand-field theory. It is shown that former assignments arose from an incorrect restriction in the application of vibronic selection rules. In the new interpretation, the two bands at 14,500 and ~15,600 cm^{-1} are attributed to a single electronic transition. The vibrational effects responsible for its double appearance are discussed. It is also noted that because of the same error in the application of vibronic selection rules former assignments of the ligand-field spectra of some nickel(II) complexes need not be correct. (auth)

6116 (TID-14533) CRYSTALLOGRAPHIC DATA. 1,3,5-TRIAMINO-2,4,6-TRINITROBENZENE. Howard H. Cady (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-eng-36]. 8p. (LADC-5135)

Optical and x-ray crystallographic studies were made of TATB(1,3,5-triamino-2,4,6-trinitrobenzene). Crude TATB was prepared by ammonolysis of trichlorotrinitrobenzene. Large crystals of purer TATB, used for the crystallographic studies, were prepared by slow recrystallization from hot nitrobenzene. X-ray powder patterns and microscopic examination revealed no crystalline impurities. (auth)

6117 (SCL-T-446) METHOD OF OBTAINING A POLYMER BASED ON p-DIETHYNYLBENZENE. I. L. Kotlyarevskii and L. B. Fisher. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.) from U.S.S.R. Patent No. 670103/23. Byull. Izobret., No. 16, 1-2(1961). 3p.

A proposed method of obtaining new polymers based on the oxidizing polycondensation of diethynylbenzene is described. The polycondensation can be performed in a polar solvent such as water, alcohol, dioxane, or pyridine in the presence of various Cu catalysts. The polymers are insoluble in water and several organic compounds but are soluble in nitrobenzene and sulfuric acid. (J.R.D.)

6118 ISOTOPE EFFECT IN THE RECRYSTALLIZATION OF D-MANNOSE-1-t PHENYLHYDRAZONE. Friedrich Weygand (Technische Hochschule, Munich), Helmut Simon, K. D. Keil, H. S. Isbell, and L. T. Sniegoski. Anal. Chem., 34: 1753-5(Dec. 1962).

An isotope effect previously reported in the recrystallization of D-mannose-1-t phenylhydrazone was reinvestigated and confirmed. The ratio of the rate of crystallization of the isotopic to that of the nonisotopic form (k^*/k) was 0.89. (auth)

6119 MEASUREMENT OF THE LIGHT YIELD OF THE SCINTILLATING SOLUTION NE 213 FROM RECOIL PROTONS. C. Joseph, J. C. Alder, G. A. Grin, J. F. Loude, and B. Vaucher (Laboratoire de Recherches Nucléaires E.P.U.L., Lausanne, Switzerland). Helv. Phys. Acta, 35: 296-9(1962). (In French)

The calculation of the efficiency of an organic scintillator for a broad fast neutron spectrum necessitates a knowledge of the light yield of the scintillator to recoil protons of the region considered. The light yield of the scintillating solution NE 213 to recoil protons was measured. The measurement principle used is shown graphically and described. The light yield of the scintillator to electrons was also measured. The results are graphed. There were two essential differences between the results obtained and those reported by M. M. Batchelor et al., (Nuclear Inst. & Meth., 13: 70(1961)). The extrapolation of the linear part of the curve crosses the axis of the energies respectively at 2.1 and 1.5 Mev. The non-linear portion is extended to 8 and 4 Mev, respectively. Possible reasons for the disagreement are indicated. (J.S.R.)

6120 THE STRENGTHS OF HYDROGEN BONDS FORMED BY PROTIUM AND DEUTERIUM. C. J. Creswell and A. L. Allred (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc., 84: 3966-7(Oct. 20, 1962).

The deuterium isotope effect in hydrogen bonding was measured for the system fluoroform–tetrahydrofuran–cyclohexane. The fluorine NMR chemical shifts of fluoroform and fluoroform-d were measured relative to hexafluoro-2,2,3,3-tetrachlorobutane. The thermodynamic constants for hydrogen bonding of fluoroform and fluoroform-d to tetrahydrofuran are tabulated; the formation constants at 25°C are 4.77 ± 0.02 and 4.95 ± 0.02 (mole fraction)$^{-1}$, respectively. (D.L.C.)

6121 THE ISOTOPE EFFECT ON ACID-CATALYZED SLOW PROTON TRANSFER IN DILUTE AQUEOUS SOLUTION. A. J. Kresge and Y. Chiang (Illinois Inst. of Tech., Chicago and Union Carbide Research Inst., Tarrytown, N. Y.). J. Am. Chem. Soc., 84: 3976-7(Oct. 20, 1962).

A study was made on the deuterium isotope effect on the acid-catalyzed aromatic hydrogen exchange in 1,3,5,-trimethoxybenzene. The reactions are expressed as

$$H'Ar + H^+(H_2O)_n \underset{k_2}{\overset{k_1}{\rightleftharpoons}} H'ArH^+ + n\,H_2O \underset{k_2}{\overset{k_1}{\rightleftharpoons}} HAr + H'^+(H_2O)_n.$$

In 0.05 M $HClO_4$, $k_1(H_2O)/k_1(D_2O) = 2.93$ and $k_2(H)/k_2(D) = 6.68$, the latter isotope effect being near the maximum value for C–H bond-breaking in a methylene group. The first isotope effect, 2.93, is in good agreement with that predicted from the O–H stretching vibration (3.6). The reasons for the high isotope effects are discussed. These isotope effects indicate that H_2O is ten times as strong an acid as D_2O. (D.L.C.)

6122 SECONDARY DEUTERIUM ISOTOPE EFFECT ON THE MALEIC ANHYDRIDE-CYCLOPENTADIENE REACTION. Dale E. Van Sickle (Stanford Research Inst., Menlo Park, Calif.). Tetrahedron Letters, No. 19; 687-90 (1961).

A small, inverse isotope effect in a common Diels-Alder reaction is reported. Maleic anhydride-d_2 was synthesized and shown by mass spectral evidence to have the composition 89.6% d_2, 7.7% d_1, and 2.7% d_0 corresponding to an atom fraction deuterium of 0.934. Combustion analysis of a mixture of deuterated maleic anhydride and the normal isotopic species showed the atom fraction deuterium to be 0.4659 and 0.4668 in duplicate runs, which corresponds to an atom fraction of 0.9356. The adduct (cis-3, 6-endo-methylene-1,2,3,6-tetrahydrophthalic anhydride) was isolated by fractional sublimation at 50°, and recrystallization from toluene followed by sublimation at 100°. Its melting point ranged from 158 to 162°. The mean k_D/k_H ratio, calculated by substituting appropriate quantities in the equation $k_D/k_H = (\log a_D/a_D^0)/(\log a_H/a_H^0)$, was 1.06. The results showed that a small, but real, inverse isotope effect was present in the reaction. The maximum isotope effect was found to be 2.2 for the simultaneous conversion of two sp^2 carbon atoms to sp^3. The expected maximum for a single carbon atom hydridization change is 1.5. (H.H.D.)

Radiation Chemistry and Radiochemistry

Refer also to abstracts 7125, 7133, 7134, and 7135.

6123 (AGN-AN-756) HYDRAZINE PROCESS DEVELOPMENT. Interim Technical Engineering Report, August through October 1962. F. R. Standerfer, H. J. Snyder, H. T. Watanabe, L. G. Carpenter, R. I. Miller, and R. L. Pearson (Aerojet-General Nucleonics, San Ramon, Calif.). Contract AF 33(600)-42996. 214p. (ASD-TR-7-840A(VII); AD-291480)

Progress is reported on a program to develop, design, construct, and operate a continuous, in-reactor, hydrazine production loop based on the fissiochemical process approach. Fission fragment distribution studies, colloidal UO_2 preparation, improvements in uranium and hydrazine analytical techniques, in-reactor loop design modifications, fission fragment deposition measurements for a variety of sources, correlation of experimental heat transfer data, and a parametric reactor systems analysis are discussed. Gas disengagement development is essentially complete. PVT relationships for nitrogen-hydrogen-ammonia mixtures are being experimentally determined over the 500 to 1000 psia, 100 to 200°F range. Distribution studies performed on the fission products of BMI slurry irradiations show that virtually all of the I^{131} and about half of the Ru^{103} are found in the decanted liquid phase; remaining non-volatile activity is adsorbed on the fuel particle surface. Three methods were evolved for converting aqueous UO_2 sols to colloidal UO_2 dispersible in liquid NH_3. Pump bearing lifetime was extended as the result of impeller shroud flange modifications. Specific area of enriched, particulate UO_2 increased from 0.6 to 2.0 m^2/grams during 0.06% burnup in the BMI slurry irradiation. In-reactor loop design was modified to incorporate a compact equipment cubicle within the MTR biological shield. The flux-measuring element was completed and delivered to the MTR. The hydrazine removal and fission gas holdup system was designed. The basic equation for the loop automatic control analysis has been translated into an analog format. Polarographic analysis showed no uranium contamination in liquid samples filtered from LPTR irradiation capsules. Statistically reliable hydrazine G-values as high as 2.2 were obtained in recent LPTR runs. More accurate calibration of energy deposition showed G_{NF_3} to be 4 in the N_2-F_2-UF_4 irradiation. The solid state detection system was used to determine fission fragment energy deposition efficiency for U_3O_8-loaded glass fibers, UO_2 powders and plates, U metal plates, and U-Al plates. A variation of the Lyon equation was applied to correlate the data derived from heat transfer loop operations. A parametric reactor systems analysis was conducted on an unreflected, spherical, slurry reactor model at diameters of 6 through 10 feet. (auth)

6124 (BNL-5838) GAMMA RADIATION INDUCED POLYMERIZATION OF ALPHA METHYL STYRENE. THE EFFECT OF WATER ON MOLECULAR WEIGHT DISTRIBUTION. C. G. Baumann and D. J. Metz (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT(30-21)-Gen-16]. 9p.

Characteristics of gamma-ray-induced polymerization such as the apparent sensitivity to traces of water and the apparent inherently poor reproducibility of data from run to run on separately prepared samples or groups of samples are examined. A brief discussion of experimental procedure and a description of one facet of the role that water apparently plays in radioinduced polymerization are included. (J.R.D.)

6125 (BNL-6016) FORMATION OF HYDRAZINE FROM THE RADIOLYSIS OF AMMONIA IN THE PRESENCE OF MINERAL SOLIDS. Henry Kramer, Jacob Pruzansky, and Meyer Steinberg (Brookhaven National Lab., Upton, N. Y.). Feb. 1962. Contract [AT(30-2)-Gen-16]. 13p.

The formation of hydrazine from the Co^{60} gamma radiolysis of ammonia in the presence of mineral solids was investigated. Sorbed ammonia on Linde molecular sieve 13X powder, binder free, (sodium aluminosilicate structure) indicated a maximum G value for hydrazine formation of 0.99 based on energy absorbed in ammonia alone. This is 12.4 times the value obtained by radiolysis of anhydrous liquid ammonia. However, the rate of hydrazine formation with sorbed ammonia on the molecular sieve is found to be only 1.2 to 3.3 times that in liquid ammonia, and is dose dependent. An energy transfer mechanism was postulated. (auth)

6126 (IEA-49) PRODUCÃO DE RADIOISÓTOPES NO INSTITUTO DE ENERGIA ATÔMICA. IÔDO 131 AND FÓSFORO 32. (Production of Radioisotopes at the Institute of Atomic Energy. Iodine-131 and Phosphorus-32). Constancia Pagano (Brazil. Instituto de Energia Atomica, São Paulo). May 1962. 21p.

The apparatus and methods for the preparation of I^{131} from irradiated telluric acid and of P^{32} from irradiated magnesium sulfate are described. In the case of I^{131}, it is sufficient to dissolve the telluric acid in water in the presence of sulfuric acid and hydrogen peroxide so that the iodine formed in the irradiation can be distilled. In the method described, the difficulties of carrier dissolution are eliminated by the use of elementary tellurium, and the final product has satisfactory radiochemical and radioactive purity characteristics. In the case of P^{32}, magnesium sulfate is used as the irradiation target. The advantage obtained by the use of material soluble in water is: ease of manipulation of apparatus made only of glass, thus avoiding the use of autoclaves or rigorous vacuum control. The techniques used to verify the purity and to determine the yield of the final product are described. (tr-auth)

6127 (NP-12303) DIE LET-ABHÄNGIGKEIT DER STRAHLENREAKTIONEN DES POLYVINYLACETATS IN LÖSUNG. (The LET-Dependence of the Radiation Reaction of Polyvinylacetate in Solution). Edgar Heckel (Hahn-Meitner-Institut für Kernforschung Berlin). [1961]. 28p.

The strong effects of linear energy transfer (LET) on the behavior of polyvinyl acetate in solution (at concentrations of 15 and 19 wt %) under the influence of ionizing radiation are described. The solvent was a mixture of 78.6 wt % trimethyl ester of boric acid and 21.4 wt % methanol. The observed effects were, at times, independent of the dosage, but depended very strongly on the specific ionization of the radiation. Radiation of higher LET such as He^4 and Li^7 particles were produced in the reaction $B^{10} + N \rightarrow Li^7 + He^4 + \gamma$ by irradiation of the solution itself with thermal neutrons. The average LET of this radiation amounted to 28 ev/Å corresponding to an average specific ionization of about 10,000 ion pairs/μ. By means of x and gamma radiation the polyvinyl acetate was converted into a three dimensional network while He^4/Li^7 radiation caused a molecular weight decrease by degradation of the chief chain. Various reaction mechanisms are discussed for explanation of these effects. (tr-auth)

6128 (ORNL-TM-438) A RAPID CHEMICAL SEPARATION FOR RADIOMANGANESE. L. C. Bate, Y. Wellwart, and J. R. Stokely (Oak Ridge National Lab., Tenn.). Dec. 6, 1962. Contract W-7405-eng-26. 9p.

A simple and rapid radiochemical separation method has been developed to separate radiomanganese from neutron-irradiated sample materials. The method is based on manganese oxide precipitations from basic and acidic media and has been successfully used in activation analysis applications for trace stable Mn. This radiochemical procedure is readily adaptable for the determination of radiomanganese species in other materials. (auth)

6129 (PAN-308/XVII) CHANGE OF INTRINSIC VISCOSITY OF POLYACRYLAMIDE AND POLYMETHACRYLAMIDE POLYMERIZED IN SOLID STATE UNDER THE INFLUENCE OF γ-RADIATION. Janina Zurakowska-Orszagh and Andrzej Robalewski (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Mar. 1962. 16p.

Changes of intrinsic viscosity of polyacrylamide and polymethacrylamide obtained by irradiation of the respective monomers in crystalline and powdered form in air and in nitrogen were investigated. The influence of the presence of atmospheric air was studied as well as degradation by post-irradiation effect. (auth)

6130 (RRL-78T) PHOTOLYSIS AND RADIOLYSIS OF IODOETHANE IN THE GAS PHASE. R. N. Schindler and M. H. J. Wijnen (Mellon Inst. Radiation Research Labs., Pittsburgh). Mar. 27, 1962. Contract AT(30-1)-2310. 6p. (NYO-10157)

All reaction products from the photolysis and radiolysis of iodoethane in the gas phase that were volatile up to 200°C were determined by gas chromatography. Hydrogen and methane were determined by mass spectroscopy. The formation of products was observed in the range of 10^{-2} to 1% decomposition. Ethane and ethylene formation are described. (M.C.G.)

6131 (TID-13363) CHEMICAL CONSEQUENCES OF BETA DECAY OF CERIUM AS THE ACETYLACETONATE. R. R. Edwards and C. D. Coryell (Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry and Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). [1961]. Contract [AT-(30-1)-905]. 10p.

Water extractions were made of solutions in CCl_4 and CS_2 of Ce(III) acetylacetonate (CeA_3) tagged with 284-day Ce^{144} and containing the 17-min Pr^{144} (formed in the β decay of Ce^*A_3 in the previous hour or so) in crystalline CeA_3 or CeA_3 in the organic solvent. The Pr^{144} was not extracted from crystalline CeA_3 freshly dissolved in CCl_4 or from CeA_3 held in CCl_4 with or without contact with water. The presence of 10% acetylacetone (HA) led to total loss of the new Pr^{144} to the water layer. Similar results were observed with CS_2 as solvent. It is concluded that the $Pr^*A_3^+$ formed in β decay of Ce^*A_3 is stabilized by charge exchange with CeA_3 to give stable PrA_3, but that HA causes the disruption of the newly formed species by bringing it to the water layer, or by bringing the reducing agent water into the organic system. (auth)

6132 (TID-17272) ACTIVATION ANALYSIS, NUCLEAR CHEMICAL RESEARCH, RADIOCHEMICAL SEPARATIONS. Progress Report No. 11, November 1961–October 1962. R. S. Maddock and W. Wayne Meinke, eds. (Michigan. Univ., Ann Arbor. Dept. of Chemistry). Nov. 1, 1962. Contract AT(11-1)-1143. 139p.

Routine operation of the Ford reactor at about 1 Mw during the year is reported. Details are given concerning measurement of reactor foils, monitoring of pile neutron fluxes, installation of an automatic rabbit catcher system, rearrangement of the laboratory counting rooms, and experiments using a Kaman neutron generator. Progress in instrumentation is reported on check-out of a 400-channel pulse-height analyzer, operation of a dual-memory 100-channel pulse-height analyzer, design of a stepping subgroup programmer, development of a time mode pulser, and design of a preamplifier for scintillation detectors. Interest in activation analysis developmental work was directed to the use of short-lived isotopes in this technique. Work is reported on analysis of marine organism ashes, rock, crude petroleum, and animal tissues. The results of several short-term studies are also reported. Work in nuclear chemistry was done with the Michigan reactor on production of Hf^{179} and on short-lived fission gases. In radiochemical separations work, detailed studies on the amalgam exchange procedure for several elements were continued. Other types of separation procedures involving immiscible solvent systems and chromatography were also explored. Work on teaching experiments in radiochemistry is reported along with the preparation of radiochemistry monographs. Separation procedures for Cu, Se, Sr, Pd, and rare earths are described. (J.R.D.)

6133 (TID-17337) HANDLING AND SEPARATION OF SHORT-LIVED RADIOISOTOPES FROM RESEARCH REACTORS. W. Wayne Meinke (Michigan. Univ., Ann Arbor. Dept. of Chemistry). [1962]. 19p.

A review of experience is presented in which the possibility of working with short-lived radioisotopes in tracer studies, activation analysis, or as sources is shown. The limiting factor is the processing and studies on processing show that it is feasible to obtain pure radioisotopes from many samples in a matter of minutes. Development of new uses is also discussed. (J.R.D.)

6134 (UCRL-9924) THE RADIOLYSIS OF LIQUID ISOBUTANE WITH PULSED ELECTRONS. B. Y. Yamamoto, A. F. Sciamanna, and Amos S. Newton (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 1961. Contract W-7405-eng-48. 10p.

Isobutane was irradiated in the liquid state with 4.2-Mev electrons from a microwave electron accelerator. Products through the octanes were identified. The heavier products are consistent with combinations of methyl, isopropyl, isobutyl, and tert-butyl radicals. Methyl cyclopropane, n-

butane, and butene-2 were formed in low yields. It is suggested that these are formed via a cyclic intermediate state. (auth)

6135 SOME APPLICATIONS ON VACUUM DISTILLATION OF METALS TO RADIOCHEMICAL SEPARATIONS. James R. DeVoe and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Anal. Chem., 35: 2-6(Jan. 1963). (TID-16901)

The applicability of vacuum distillation of metals to radiochemical separations was explored using mercury, indium, and cadmium as examples. Separations studied include those which couple chemical reduction or electrolysis from solution with volatillization, as well as carrier-free separations made directly from solid metals. Critical evaluations are included for yield and contamination. The degree of separation afforded by the technique for various molar ratios of cadmium–zinc and cadmium–silver was also studied. (auth)

6136 CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS. L. Lindner. Atoomenergie Haar Toepassingen, 4: 177-84(Sept. 1962). (In Dutch)

In "high-energy chemistry," in contrast to radiochemistry, one is not interested in the chemical changes which a particle induces in the surrounding matter, but rather in the chemical fate of the particle itself. In the present article, consideration is given to some experimental results which can give an insight into the chemical processes which can ultimately lead to stabilization of the particles formed. (tr-auth)

6137 A STATISTICAL THEORY OF HOT ATOM CHEMISTRY. [PART] II. R. Frère (Centre d'Études Nucléaires, Mol, Belgium). Bull. Classe Sci., Acad. Roy. Belg., 48: 296-301(Mar. 1962). (In English)

Using the model established in paper I, the chemical effects which result from a multiplying system of hot particles were studied. The "first collision equation" treatment of the general Markoff cascade is applied to hot atoms. Semi-invariants characterizing the distribution of the number of hot products (average value and dispersion) may be computed, by using the generating function of that distribution. (auth)

6138 PREPARATION OF TRITIUM-LABELED ATROPINE AT HIGH SPECIFIC ACTIVITY. E. A. Evans (Radiochemical Centre, Amersham, Bucks, Eng.). Chem. Ind. (London), 2097(Dec. 23, 1961).

Atropine labeled with H^3 was prepared at high specific activity by exposure of finely powdered dry atropine to H^3 gas for 3 weeks. Finely powdered dry atropine (293 mg) and H^3 gas (~40 ml, 100 c of at least 90% isotopic purity) were left with occasional shaking, at room temperature for 22 days. After the removal of excess H^3 gas and volatile products, the tritiated product was equilibrated several times with ethanol (3 × 5 ml), the ethanol being distilled in vacuo each time. This process removed labile H^3 attached to the hydroxyl group of the tropic acid part of the molecule. The product was dissolved in acetone (5 ml) and carrier inactive atropine (100 mg) added; the acetone was evaporated and the residue sublimed in vacuo (bath temperature 120–130°C) giving atropine; mp 118°C and specific activity 2.4 c/millimole. Some (30 mg) of the material was converted to picrate by dissolving the compound in water and adding an excess of a saturated solution of picric acid. After two recrystallizations from water, atropine picrate, mp 176°C at a constant specific activity of 2.02 c/millimole, was obtained. The radiochemical purity of the tritiated atropine was no more than 80%. Atropine (150 mg at 0.69 mC/mm) was hydrolyzed with 10% aqueous NaOH. The isolated tropine had a specific activity of 0.3 mC/mm and the tropic acid 0.25 mC/mm. Thus during the irradiation with the H^3 gas, 43% of the nonlabile H^3 incorporated into the atropine molecule entered the tropine base and 32% into the tropic acid part, the remaining 25% being lost under the hydrolysis conditions. (H.H.D.)

6139 RADIOLYSIS OF o-TERPHENYL WITH Po-210 ALPHA PARTICLES. J. Y. Yang, F. C. Goodspeed, and J. G. Burr (Atomics International, Canoga Park, Calif.). Chem. Ind. (London), 1018-19(June 9, 1962).

Polymer yields produced from o-terphenyl by irradiation with alpha particles of 1–1.5 Mev energy from a Po^{210} source were determined over the temperature range of 60 to 300°C. The plot of log G(-M) (the number of terphenyl molecules represented by a given weight of polymer) versus 1/T°K gave a linear function; from the slope a low apparent activation energy of 1.3 kcal/mole can be derived for polymer formation. G(-M) values varied from 0.41 at 60° to 0.90 at 300°C. The results were in agreement with recent observations of linear energy transfer (LET) effects in the formation of certain C_{12} products from benzene. The value of G(-M) for fast-neutron irradiation of o-terphenyl, calculated by assuming that the plot of polymer yield versus log LET is linear, was 0.7, in good agreement with the previous values estimated for isomeric terphenyls. The small magnitude of the LET effect compared with the LET effects in aqueous systems reflected the minor importance of track effects in the liquid o-terphenyl system, and the very small value for the activation energy suggested that the initiating radical was an energetic radical and not a thermal radical. (H.H.D.)

6140 THE RADIATION SYNTHESIS OF NEW ION-EXCHANGE SORBENTS CONTAINING MINERAL AND ORGANIC COMPONENTS. E. V. Egorov, P. D. Novikov, D. R. Razgon, and B. L. Tsetlin (Inst. of Chemical Physics, Academy of Sciences, USSR and Inst. of Elementary Organic Compounds, Academy of Sciences, USSR). Doklady Akad. Nauk SSSR, 146: 1360-2(Oct. 21, 1962). (In Russian)

An organic monomer was grafted to a mineral sorbent by irradiating powdered silica gel (primarily SiO_2) with x rays (integral dose of 5×10^6 rads), at a temperature of 90°C with a monomer vapor pressure of 30 mm in the case of styrene, and 25 mm Hg in the case of acrylic acid. The mineral-organic product contained 21 wt % of grafted polystyrene (with respect to the SiO_2 content) which was sulfonated by treatment with H_2SO_4 in the presence of a silver catalyst at 60°C. The resulting product showed ion-exchange properties with a total capacity of 1.4 mg-equivalent/g, as determined in 0.1N NaOH. The exchange capacity of the unsulfonated resin was 0.5 mg-equivalent/g. The ion-exchanger does not swell in water or in aqueous solutions. A mineral-organic ion-exchanger with functional carboxylic groups was obtained by using powdered silica gel and acrylic acid as a monomer. This resin did not swell in water, and had an exchange capacity of 3 mg-equivalents/g. Equilibrium between a dilute salt solution and the resin was established much more rapidly with the mineral-organic resin than with a conventional resin such as sulfonated polystyrene. Thus, in a 2×10^{-4}N salt solution, equilibrium was established within 10 minutes for the mineral-organic resin, but only 13% of the equilibrium capacity was used up in a KU-2 resin (a sulfonated polystyrene resin). (TTT)

6141 PREPARATION OF PHOSPHORUS-32 BY DISTILLATION OF IRRADIATED SULFUR. Felipe de la Cruz, Cristina Suarez, and German Dominguez. Energia Nucl. (Madrid), 6: 4-15(Apr.-June 1962). (In Spanish)

There are three principal methods for the separation of

P^{32} formed in the neutron irradiation of sulfur: hot acid leaching of irradiated sulfur, boiling water leaching of irradiated sulfur in the presence of a wetting agent, and distillation of irradiated sulfur. An experimental study is made of the distillation method to determine the degree of purity obtainable through the dissolution of the distillation residue. An installation for the distillation of the irradiated sulfur and the dissolution of the P is described. (J.S.R.)

6142 GAS PRODUCTION AS A RESULT OF GAMMA IRRADIATION OF SUGAR SYRUPS. D. Emery, P. Burchill, D. Hamerski, and G. Germann (General Mills, Inc., Minneapolis). Food Technol., 16: No. 7, 124-5(July 1962).

Gamma irradiation of sugars or sugar solutions produced a significant quantity of gas. Pressures developing in 1-pint jars of 30% sucrose solution were determined after 1- and 5-megarad Co^{60} irradiation in the source and for 150 min after removal from the source. The pressure at 1 megarad was 0.81 psi, and at 5 megarad 9.68 psi. The postirradiation pressure increased about 0.7 psi in 2 hr. At the end of 150 min, the pressure was still increasing but at a greatly reduced rate. Differences in the pressure produced were small in the sugar concentration range of 20–40%. The pressure produced with a 30% glucose solution was somewhat higher than that for sucrose at a corresponding concentration; the glucose solution reached 14.5 psi at 5 megarad and 16 psi at 180 min postirradiation. Mass spectroscopic analysis was performed on the gas samples, and showed that the major constituent of the liberated gas is H, which accounted for over 90% of the volume. The findings have important implications in any consideration of the radiation preservation of high-sugar food items in gas-impermeable containers. (H.H.D.)

6143 RADIOLYTIC OXIDATION OF p-XYLENE. T. Costea, C. Mantesco, and I. Negoesco (Institutional de Fizica Atomica, Bucharest). Intern. J. Appl. Radiation Isotopes, 13: 306-7(June 1962). (In French)

The radiolytic oxidation of p-xylene under 1 atm of O_2 and at 60 to 130°C is studied, in the biological shield of a reactor (gamma dose rate = 1.25×10^{13} ev · g^{-1} · sec^{-1}, fast neutron flux = 10^7 cm^{-2} · sec^{-1}). About 15 hr of irradiation are required to induce a radiolytic yield on the order of 1%; in order to increase the yield an activator is added to the unirradiated p-xylene, following which addition, an irradiation time of only 8 hr results in a yield of p-toluic acid of 18 to 22%. (T.F.H.)

6144 A RADIOCHEMICAL METHOD FOR MEASURING RADICAL YIELDS IN THE RADIOLYSIS OF LIQUID HYDROCARBONS. R. A. Holroyd and G. W. Klein (Mellon Inst., Pittsburgh). Intern. J. Appl. Radiation Isotopes, 13: 493-9(Sept. 1962). (RRL-76). (In English)

A radiochemical technique was developed to measure the yields of radical species produced in the radiolysis of liquid hydrocarbons. Radioactively labeled ethyl radicals, formed during the irradiation of addition of hydrogen atoms to ethylene-C^{14}, scavenge radicals to an extent proportional to their relative concentrations. The yields of C^{14}-labeled hydrocarbons measure the corresponding radical yields. Results are given for n-pentane. The total activity in each component is measured with a flow proportional counter connected to the effluent of a conventional gas chromatographic detector. This labeling technique is essential in distinguishing the products of the scavenging reaction from the multitude of products ordinarily observed in the radiolysis of liquid hydrocarbons. The technique can also be used to prepare labeled hydrocarbons of specific activity approaching that of the ethylene used. (auth)

6145 FREE RADICAL REACTIONS INITIATED BY IONIZING RADIATION. II. RATE CONSTANTS FOR HYDROGEN ATOM ADDITION REACTIONS WITH MONOOLEFINS, BUTADIENE AND BENZENE. Kang Yang (Continental Oil Co., Ponca City, Okla.). J. Am. Chem. Soc., 84: 3795-9(Oct. 20, 1962).

Various olefins reduce the rate of formation of hydrogen in the gamma radiolysis of propane. The effect of temperature on this inhibition strongly indicates that it results from the hydrogen atom addition reaction H + olefin $\xrightarrow{k_s}$ H-olefin. Rate constants k_s for these addition reactions are determined for the compounds: butadiene-1,3, isobutene, tetramethylethylene, trans- and cis-butene-2, and benzene. These data together with the results of Part I are used to pursue correlations between activation energies (but not log k_s) and reactivity indices computed by a simple molecular orbital theory. It is found that $\epsilon = aE_{loc} - b$, where ϵ denotes activation energy, E_{loc} signifies localization energy, and a and b are constants. Free valency fails to give a similar linear relation. (auth)

6146 MERCAPTANS AND DISULFIDES AS INHIBITORS OF NON-CHAIN PHOTOCHEMICAL AND RADIATION-INDUCED REACTIONS. Saul G. Cohen, Stanley Orman, and Daniel A. Laufer (Brandeis Univ., Waltham, Mass.). J. Am. Chem. Soc., 84: 3905-12(Oct. 20, 1962).

The photochemical conversion of benzophenone and 2-propanol to benzpinacol and acetone is retarded and inhibited by certain mercaptans and disulfides present in low concentration. The retarded reactions start at time zero and proceed at essentially constant rate with zero-order kinetics. Inhibition does not lead to consumption of the inhibitor, initially present mercaptan or disulfide being converted to an equilibrium mixture of the two. Inhibited reactions carried out in optically active 2-octanol in place of 2-propanol lead to racemization; irradiation of active 2-octanol with benzophenone or disulfide separately does not lead to racemization. Inhibition results from repeated reaction of the sulfur compounds in their two valence states with the normal free radical intermediates, the sulfur compounds being converted to their alternate, still reactive, valence states, the radicals being converted to the starting materials. The Co^{60} γ ray-induced conversion of benzophenone to benzpinacol in 2-propanol is also inhibited by mercaptan and disulfide, presumably by a similar mechanism. These reactions provide a chemical mechanism by which one molecule may dissipate the energy introduced by, and the chemical consequences of, the absorption of many quanta of radiation. (auth)

6147 ON THE NATURE OF SOME HIGHER BORON HYDRIDES PRODUCED IN RADIATION-INDUCED REACTIONS IN PENTA- AND DECABORANE. L. H. Hall and W. S. Koski (Johns Hopkins Univ., Baltimore). J. Am. Chem. Soc., 84: 4205-7(Nov. 20, 1962).

The mass spectra of the solid products produced by deuteron irradiation of mixtures of various known boron hydrides revealed several groups of peaks attributed to some new higher hydrides of boron. Small amounts of the hydrides were obtained by separation in a vapor-phase chromatograph. The mass spectra of the isolated materials yielded molecular weights which suggest that the new higher hydrides were produced by the coupling of smaller polyhedral units. The irradiation of pure pentaborane-9 and decaborane-14 is shown to produce two new hydrides identifiable from their mass spectra as decaborane-16 and icosaborane-26. (auth)

6148 ELECTRON ATTACHMENT AND SOLVATION IN GAMMA IRRADIATED ORGANIC GLASSES AT −196°.

Michael R. Ronayne, John P. Guarino, and William H. Hamill (Univ. of Notre Dame, Ind.). J. Am. Chem. Soc., 84: 4230-5(Nov. 20, 1962).

Gamma irradiation at −196° of organic glasses containing small amounts of solutes whose anion absorption spectra were known resulted in the formation of optically identifiable anions by electron attachment. Using a tetrahydro-2-methylfuran glass the limiting value for G(anions) was 2.6 for naphthalene and 3.2 for biphenyl. With a hydrocarbon glass, the limiting yields were 1.1 and 1.7, respectively. For biphenyl in ethanol, G(anion) = 2.94. In all media, G(anion) = 1 for about 0.05 mole % additive. Anions of nitrobenzene, benzophenone, and tetracyanoethylene were also prepared by both methods and identified while spectra of styrene and carbon tetrachloride molecular anions, which cannot be prepared chemically, appeared to form in gamma irradiated glasses. Irradiation of glassed tetrahydro-2-methylfuran alone produced a structureless absorption band in the visible and near infrared. With less than 0.5 mole % of naphthalene, the solute anion and solvent spectra both appeared. The solvent spectrum can be selectively bleached, with a concomitant increase in the solute anion absorption bands. The facts indicate that the solvent absorption is due to solvated electrons. Similarly solvated electrons are observed in gamma irradiated ethanol but not in glassed alkanes or alkenes. (auth)

6149 EFFECT OF AMMONIA ON THE RADIATION-INDUCED POLYMERIZATION OF CYCLOPENTADIENE AT −78°. M. A. Bonin, W. R. Busler, and Ffrancon Williams (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc., 84: 4355-6(Nov. 20, 1962).

It is shown that radioinduced polymerization of cyclopentadiene is an ionic reaction. Cyclopentadiene was found to polymerize reproducibly when irradiated at −78°C with Co^{60} gamma rays. Ammonia was found to reduce the polymerization yield, which was linear with irradiation dose up to about 20% conversion $G(-C_5H_6) = 25000$, at low concentrations by virtue of its possession of an unshared pair of electrons. (P.C.H.)

6150 SZILARD-CHALMERS CHEMISTRY AND RADIATION CHEMISTRY OF SOLID HEXABROMOETHANE. THERMAL ANNEALING AND RADIATION ANNEALING EFFECTS. Kenneth E. Collins and John E. Willard (Univ. of Wisconsin, Madison). J. Chem..Phys., 37: 1908-17 (Nov. 1, 1962). (TID-15991)

The effects of ionizing radiation and thermal treatment on the chemical fate of Br^{82} atoms produced in solid C_2Br_6 by the $Br^{81}(n,\gamma)Br^{82}$ process were investigated. Three chemically distinguishable forms of Br^{82} were found, using two methods of analysis. One method involved determination of the fraction of the Br^{82} which is extractable into aqueous solution when the irradiated C_2Br_6 is dissolved in CS_2 and the other involved dissolution in liquid Br_2 followed by evaporation of the solvent. The aqueous yield of Br^{82} in C_2Br_6 irradiated with neutrons at −196° and analyzed at 0° under the conditions of the investigations was 34%. This lowered to about 24% by heating to 100° for an hour prior to analysis. Exposure of the crystals to 10^{20} ev g^{-1} of Co^{60} gamma radiation at −196° either before or after neutron irradiation did not affect the yield if analysis was made without thermal annealing but lowered it to 3.5% for samples annealed 1 hr at 100°. Analyses of thermal annealing curves at several gamma doses and several temperatures indicated the existence of several processes by which gamma defects and Br^{82}-containing defects are annealed. $G(Br_2)$ from the radiolysis of C_2Br_6 was reduced by thermal annealing in a manner having similarity to the annealing of Br^{82}. Implications of the data are discussed. (auth)

6151 ENERGY-TRANSFER PHENOMENA AND DISSOCIATION PROCESSES IN ELECTRONICALLY EXCITED MOLECULES. J. C. Lorquet, S. G. ElKomoss, and John L. Magee (Univ. of Notre Dame, Ind.). J. Chem. Phys., 37: 1991-2000(Nov. 1, 1962).

The influence of electronic coupling on dissociation mechanisms was investigated. Linear chains of diatomic molecules were used as the model. The use of a dynamical version of the Hellmann-Feynman theorem allowed the development of a unified treatment valid for any coupling. An application to an infinite linear chain of hydrogen molecule-ions was made. In the weak-coupling case, immediate dissociation occurred. In the intermediate case, the electronic excitation energy was converted into vibrational energy, mainly localized on the molecule initially excited. Redistribution of the vibrational energy then occurred. In the strong-coupling case, dissociation did not occur. Many molecules vibrated with comparable amplitudes. Short chains, containing two, three, four, and seven molecules, were also considered. For these it was found that two or more dissociations usually occurred regardless of the type of coupling and initial position of the excitation. Finally, an application to intramolecular energy transfer was attempted. The case of the radioinduced isomerization of cis-polybutadiene into its trans isomer, was examined. (auth)

6152 ELECTRON SPIN RESONANCE OF GAMMA-IRRADIATED SINGLE CRYSTAL OF ACETYL-L-GLUTAMIC ACID. Mikio Katayama (Duke Univ., Durham, N. C.). J. Chem. Phys., 37: 2143-6(Nov. 1, 1962).

The electron spin resonance spectra of gamma-irradiated single crystals of acetyl-L-glutamic acid were measured at 9 and 23.4 kMc/sec for various orientations of the crystal in the external magnetic field. The structure of the free radical produced immediately after the irradiation of acetyl-L-glutamic acid was derived from the analysis of the hyperfine interaction constants. However, the radical transforms to another more stable one in the half-life of three days. The structure of the stable free radical is inferred from the hyperfine structure of its electron spin resonance. (auth)

6153 PAPER-ELECTROPHORETIC STUDIES OF THE SOLUTION CHEMISTRY OF RaD (^{210}Pb), RaE (^{210}Bi) AND RaF (^{210}Po). II. IN NITRIC ACID AND PERCHLORIC ACID. S. K. Shukla and J.-P. Adloff (Centre de Recherches Nucleaires, Strasbourg). J. Chromatog., 9: 455-60(Dec. 1962). (In English)

An attempt was made to define the concentration range of nitric and perchloric acids which give separations of RaD, RaE, and RaF in electrophoresis on paper. The effect on the ionic nature of the elements of varying the concentration of these acids and also of the progressive replacement of nitric acid by potassium nitrate, keeping the NO_3^- ion concentration constant, was examined. In very dilute nitric acid, 0.0005$\bar{N}$, all three elements were hydrolyzed. Studies in perchloric acid could be made only in the concentration range 0.01 to 1.0$\bar{N}$. (auth)

6154 STUDY OF ELECTRON MAGNETIC RESONANCE SIGNALS AT 9000 MHZ GIVEN BY GLYCOCOL MONOCRYSTALS IRRADIATED WITH γ OR WITH X RAYS. Andre Bottreau (Faculte des Sciences, Bordeaux). J. Phys. Radium, 23: 445-7(July 1962). (In French)

A variation of the hyperfine structure of a crystal irradiated with γ rays was observed at room temperature. However, for each orientation of the monocrystal, a variation of the hyperfine structure was obtained when the tempera-

ture was lowered. A spectral anisotropy was observed also in the case of γ irradiation. The spectrum obtained five days after irradiation indicates the existence of an unstable radical of short life. The results obtained after a second irradiation with x rays are shown. The experimental results are interpreted to indicate the presence of three radicals. An explanation of the effects of temperature is given. The spectral differences obtained with different modes of radiation are indicated. (J.S.R.)

6155 RADIATION-INDUCED SOLID STATE POLYMERIZATION. S. Okamura (Kyoto Univ.). Kagaku No Kogyo (Osaka), 14: 782-91(Sept. 1961). (In Japanese)

Recent studies on radiation induced solid-state polymerization reactions are reviewed, pointing out special reactions in which the radiation-induced polymerization offers valuable data to solid state chemistry. The reactions discussed include solid-state radical polymerization, solid-state ionic polymerization, and polymerization of cyclic polymers. The experiments were carried out with a Co^{60} source while the compounds investigated included β-propiolacetone, diketene, 3-3 bis-chloromethyl oxabutane, and trioxane. (TTT)

6156 PRODUCTION AND APPLICATION OF RADIONUCLIDES IN EUROPE. H. J. Born, and H. J. Marcinowski (Isotopen-Studiengesellschaft e. V., Frankfurt am Main). Kerntechnik, 4: 573-9(Dec. 1962). (In German)

This is a survey on the most important reactors, accelerators, and separation plants for the production of radionuclides, where questions of distribution are also treated. By excerpt of the rather disperse and varying sources the application of radionuclides in the different European countries is reported on. Finally, the influence of law and administration concerning this subject is indicated. (auth)

6157 WEST-EUROPEAN RESEARCH LABORATORIES FOR HIGH RADIOACTIVE MATERIALS. G. Boehme and W. Koehler (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H., Karlsruhe, Ger.). Kerntechnik, 4: 580-2(Dec. 1962). (In German)

Hot cells for reactor development and the production of isotopes are discussed. Because of the high building expenses they are almost exclusively national ones or financed on a supernational basis. In the way of construction and equipment they resemble very much American examples, on the continent mainly British schedules are employed. (auth)

6158 VACUUM EVAPORATOR FOR PREPARING RADIOACTIVE SOURCES USED IN NUCLEAR SPECTROSCOPIC EXPERIMENTS. János Schadek, Dénes Berényi, and Tibor Fényes. Magy. Tud. Akad. Atommag Kut. Int. (Debrecen) Kozlemen., 4: 119-23(Aug. 1962). (In Hungarian)

The design, characteristics, and operating behavior of the vacuum evaporator are described. (T.F.H.)

6159 RADIOCHEMICAL THERMAL DECOMPOSITION OF PETROLEUM PRODUCTS. Gabor Foldiak (Hungarian Petroleum- and Natural Gas Research Inst., Budapest). Magy. Tud. Akad. Kem. Tud. Oszt. Kozleman., 18: 433-45 (1962).

On the basis of experiments with high-energy irradiation of paraffin oil, the existence of a radiochemical thermal decomposition limiting temperature, whose calculation was performed previously, was demonstrated. The temperature was found to be 220-250°C. Above this temperature the average energy level of the system ensures a continuous chain reaction if the start of chains is made possible by other methods, in this case by irradiation. The limiting decomposition temperature of paraffin oil did not depend on the parameters of the irradiation. Experimental results showed that the chain decomposition reaction above the limiting temperature depended to a great extent on the parameters of the irradiation: with increasing dose the length of the chain reaction also increased. It was shown that addition of an aromatic substance to the paraffin oil significantly suppressed the chain reaction above the limiting temperature, so that 6% p-terphenyl actually blocked the chain reaction completely. Addition of aromatic compounds, however, did not affect the limiting temperature proper. It was demonstrated by means of radiochemical methods that it is possible to investigate the kinetics of certain nonradiochemical processes according to reaction type. (OTS)

6160 ANNEALING BEHAVIOUR OF PHOSPHORUS-32 RECOILS IN POTASSIUM CHLORIDE CRYSTALS. J. S. Butterworth and I. G. Campbell (Univ. of Manchester, Eng.). Nature, 196: 982-3(Dec. 8, 1962).

Evidence is reported for a reductive reaction involving P^{32} recoils during the thermal annealing of reactor-irradiated KCl crystals. A difference in behavior between recoil-induced defects and radiation-induced defects is noted. (L.T.W.)

6161 SOME CHEMICAL REACTIONS INITIATED BY FISSION ENERGY. P. Harteck. Nippon Genshiryoku Gakkaishi, 4: 627-35(Sept. 1962. (In Japanese)

A summary is presented of a lecture given at the Japan Atomic Energy Research Institute in August 1961 about the applications of the fission energy in radiation chemistry. Results of the author's experiments, carried out during the last 10 years at the Brookhaven National Laboratory's reactors are presented, including studies on the decomposition of CO_2 and the fixation of nitrogen. Chemical reactions induced by fission energy in low and high pressure systems of CO_2, $CO_2 + N_2$, and $N_2 + O_2$ and the effects of additional reactants are discussed in detail. (TTT)

6162 ELECTRON SPIN RESONANCE OF X-IRRADIATED ORGANIC INCLUSION COMPOUNDS. O. Hayes Griffith and Harden M. McConnell (California Inst. of Tech., Pasadena). Proc. Nat., Acad. Sci. U. S., 48: 1877-80(Nov. 15, 1962).

The use of organic inclusion compounds for the investigation of long-lived free radicals produced by x radiation is reported. Using urea compounds as examples, three applications of organic inclusion compounds are given. They are: the identification of stable free radicals not observed in x-ray damaged single crystals of the molecule itself; the study of radiation damage in a molecule with unknown crystal structure; and the investigation of x-ray damage of a compound which is a liquid at room temperature. Adipic acid, fumaric acid, and ethyl heptanoate-urea inclusion compounds were studied. (P.C.H.)

6163 RADIATION-INDUCED CHEMICAL CHANGES IN AQUEOUS SOLUTIONS OF TRYPTOPHAN. N. A. Duzhenkova, Yu. D. Parfenov, A. V. Savich, and E. I. Yartsev. Radiobiologiya, 2: 662-6(1962). (In Russian)

The irradiation of a 2.5×10^{-4}M solution of tryptophan gives NH_3, kynurenine (estimated by its absorption at λ = 360 mμ), and anthranilic acid (estimated by adsorption at λ = 310 mμ). The deamination of tryptophan was proportional to the dose with a $G(NH_3)$ yield of 0.58 molecules/100 ev. At low irradiation doses, the G yield for the formation of kynurenine was found to be 0.3 molecules/100 ev, and the G yield for anthranilic acid was 1.0 to 1.3 molecules/100 ev. The maximum yield of radiolytic products was obtained at 3 to 5×10^{-4}M concentrations of tryptophan. The pH has an effect on the yield. With a ratio of tryptophan to cysteine

of 10 to 1 and a Co^{60} dose of 320 krads (1.85×10^{19} ev/ml), cysteine showed a protective effect on the deamination of tryptophan, especially in acid solutions. It is postulated that cysteine acts as an acceptor of OH radicals in acid solution. The addition of persulfate had no effect on the radiation yields of irradiated tryptophan solutions. (TTT).

6164 IONIZATION AND DISSOCIATION OF DEUTERATED ETHYL AND ISOPROPYL ACETATES AND ETHYL FORMATE UNDER ELECTRON IMPACT. E. W. Godbole and P. Kebarle (Univ. of Alberta, Edmonton, Can.). Trans. Faraday Soc., 58: 1897-1904(Oct. 1962).

The mass spectra of $HCO_2CD_2CH_3$, $CH_3CO_2CD_2CH_3$, $CD_3CO_2CH(CH_3)_2$, and $CD_3CO_2CD(CH_3)_2$ were compared with the spectra of the H-containing compounds. The labeling helps determine the origin of a number of fragment ions. The rearrangement ion CH_3O^+ was found to originate from the process $HCO_2CH_2CH^+$ (excited) $\rightarrow HCO_2CH_2^+ + CH_3 \rightarrow CH_3O^+ + CO$. It was found that the rearrangement ions $CH_3CO_2H^+$ and $CH_3C(OH)_2^+$ are formed by a random transfer of H atoms from the alkyl group. Appearance potentials of the ions led to an estimate of the proton affinity of acetic acid = 178 kcal/mole. The influence of substituents on the proton affinity of acids was examined. (auth)

6165 THE REACTIVITY OF OH RADICALS WITH FERRO-FERRICYANIDE, FORMATE, ETHANOL AND AMINO ACIDS IN IRRADIATED SOLUTIONS. Joseph Rabani and Gabriel Stein (Hebrew Univ., Jerusalem). Trans. Faraday Soc., 58: 2150-9(Nov. 1962).

Aqueous solutions containing ferro- and ferricyanide were used in the pH range 2.5 to 10.5 to investigate the reactions of OH radicals produced by ionizing radiations. In the presence of added organic substrates: ethanol, formic acid-formate, glycine, or alanine, the rate constant ratio $k_{OH+ferrocyanide}/k_{OH+RH_2}$ was determined. As the ferro-ferricyanide system does not change with pH in this range the respective reactivities of the different ionic forms of the organic substrates with OH radicals were derived. The results are compared with the reactions of OH radicals in other systems. Indications of the increased reactivity of OH radicals in aqueous solution were obtained and are compared with the gas phase. (auth)

6166 GAMMA RADIATION EFFECT ON COMBINED ACRYLONITRILE AND ETHYLENE POLYMERIZATION. V. F. Gromov, P. M. Khomikoviskii and A. D. Abkin. Vysokomolekul. Soedin., 3: 1015-20(1961). (In Russian)

Studies were made of radioinduced ethylene and actylonitrile polymerization by Co^{60} in toluene solution at 10 to 45 atm pressure, 30 r/sec, and 20°C temperature. The concentration of ethylene in acrylonitrile–toluene mixtures was determined by the volume of ethylene saturation in a specially designed device. The tabulated data on ethylene and acrylonitrile concentrations dissolved in toluene at various monomer ratios showed that at acrylonitrile-ethylene ratios 0.5 : 0.5, 0.3 : 0.7, and 0.1 : 0.9 the monomer concentrations are almost identical. (R.V.J.)

6167 THE REACTION OF WHITE PHOSPHORUS WITH CARBON TETRACHLORIDE UNDER THE INFLUENCE OF γ RADIATION, LIGHT AND HEAT. D. Perner and A. Henglein (Hahn-Meitner-Institut für Kernforschung, Berlin). Z. Naturforsch., 17b: 703-11(Nov. 1962). (In German)

Red phosphorus, phosphorus trichloride, trichloromethylphosphorus dichloride, hexachloroethane, and a polymer consisting of carbon and chlorine are formed when solutions of white phosphorus in carbon tetrachloride are exposed to γ-radiation. Red phosphorus is the main product at room temperature. However, its yield rapidly decreases at higher temperatures and the yields of the low molecular weight products strongly increases. Typical G-values are given. The formation of the products PCl_3 and CCl_3PCl_2 occurs by a chain reaction between phosphorus and carbon tetrachloride. A mechanism is proposed in which free radicals from the radiolysis of carbon tetrachloride attach the dissolved white phosphorus. The propagation of the chain is caused by chlorine transfer from carbon tetrachloride to partly trichloroalkylated or chlorinated phosphorus chains or rings. The activation energy of this transfer is found to be equal to 8.2 kcal/mole. This reaction with carbon tetrachloride is favored at high temperature while the competing process of the combination of those intermediate phosphorus chains and rings to give red phosphorus predominates at low temperature. The red phosphorus formed contains one CCl_3 group per 7 atoms of phosphorus. It was possible to synthesize trichloromethylphosphorus dichloride, trichloromethylphosphorus tetrachloride and trichloromethylphosphorus dibromide by treating the red phosphorus with chlorine or bromine, respectively. The thermal reaction between phosphorus and carbon tetrachloride also leads to PCl_3 and CCl_3PCl_2 (ratio 1 : 3). Small amounts of red phosphorus and C_2Cl_6 could be traced too. The activation energy of the thermal reaction amounts to 22.2 kcal/moles. The photo reaction (visible light) leads to the same products. However, red phosphorus still is the main product at 100°C. (auth)

6168 CONCERNING THE FORMATION OF ORGANIC SUBSTANCES FROM CARBON DIOXIDE IN AQUEOUS SOLUTION BY MEANS OF Co^{60} GAMMA RADIATION. Nikola Betoff (Inst. for Radium Research and Nuclear Physics, Vienna). Z. Naturforsch., 17b: 751-7(Nov. 1962). (In German)

The reduction of carbon dioxide in aqueous solutions and the formation of organic materials by means of Co^{60} gamma radiation are reported. The investigation was carried out in a pH region from 2 to 10.9. From that it could be established that the yields of the organic materials such as aldehydes, formic acid, etc. as well as those of H_2O_2, H_2, CO, and O_2 depend strongly on pH value and radiation dose. The H_2 yield reaches a maximum in the acid region (pH 2 to 4) and a dose of 2.3×10^{18} ev/ml. In the presence of ferro-ions at pH 3.7 no maximum was observed since it exerts a certain protective effect. The carbon monoxide, often an intermediate product in the reduction process, could be detected in the entire pH region from 2 to 10.9. At pH 7 oxygen was also identified and its yield increased with the pH value. The principal products of the carbon dioxide reduction scheme are CO, CO^-, CO_2^-, HCO, and COOH. It was assumed that in the reduction process the lost electrons play a decisive role along with the free radicals and protons. A series of possible reactions in the reduction process are given. (tr-auth)

6169 DESIGN OF A CHEMICAL PROCESSING APPARATUS FOR RADIOISOTOPES OF SHORT HALF-LIFE. M. Douis and M. Valade (Centre d'Études Nucléaires, Saclay, France). IAEA Preprint SM-32/3. 21p. (In French)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

Suggestions are made for radiochemists having at their disposal a small reactor (e.g., 10^{12} n/cm^2/s flux) regarding which radioisotopes can be prepared and the minimum equipment required. The topics discussed include: (1)

Possible radioisotopes; (2) Chemical processing; and (3) Preparation areas. (auth)

6170 PRODUCTION OF SHORT-LIVED ISOTOPES IN THE VVR-M REACTOR. I. A. Kondurov and D. A. Yashin (Joffe Physico-Technical Inst., Leningrad). IAEA Preprint SM-32/5. 16p. (In Russian)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The production of short-lived isotopes in the VVR-M reactor is discussed, from the loading of the sample for irradiation to its extraction from the hot chambers. The mechanism for handling the containers with the irradiated samples can be used in all existing and projected reactors with eccentric upper shielding covers. The irradiated samples are extracted with the aid of an unloading box designed and constructed to suit conditions in the VVR-M reactor. Along with the standard method of producing radioisotopes, various experimental facilities for carrying out research on short-lived isotopes are described. In particular, a description is given of special equipment for research on F^{20} and Mn^{56} and of apparatus for studying radioactive isotopes with a half-life of 0.01 sec or less; other procedures employed in the horizontal and vertical channels of the VVR-M reactor for studying short-lived isotopes are also described. (auth)

6171 PRODUCTION AND USE OF THE ISOTOPES Na^{24}, K^{42}, Cu^{64} AND Mo^{99}. R. Loos (Université Lovain, Léopoldville, Congo). IAEA Preprint SM-32/7. 8p. (In French).

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

Elements are normally irradiated in the 50 kw Triga Reactor's rotary specimen rack under a flux of 3×10^{11} n/cm^2/sec, but in some special cases they are placed in the central thimble where there are 2×10^{12} n/cm^2/sec at the point of maximum flux. Samples are irradiated in a suitable chemical form and gamma spectrometry is used to ensure that no unwanted isotopes are present. Counting is usually done with single-channel analyzers. The multichannel analyzer is used for experiments involving two radioactive tracers. (W.D.M.)

6172 PREPARATION OF TELLURIUM-132 AND IODINE-132. R. Stiennon-Bovy and G. Haegeman-Geladi (Centre d'Étude de l'Énergie Nucléaire, Mol, Belgium). IAEA Preprint SM-32/40. 26p. (In French)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The methods for isolating Te-132 from irradiated uranium and fission products and for separating I-132 from Te-132 are described. The conditions are specified in which the Te-132 and the I-132 have to be obtained and experimental details are given on how these conditions can be attained using alumina chromatography both for isolating the Te-132 and for separating the I-132 therefrom (effect of the amount of entraining agent and of temperature, tolerance of impurities, etc). The composition and stability of entraining agent-free solutions of Te-132 and I-132 are studied and different methods of calibrating both solutions are compared. A description is given of the cell intended for the production of 500 millicuries of Te-132 per run. A description is also given of shielding which can be used for transport and storage purposes, and during use of the chromatography columns loaded with radioactive substances. (auth)

6173 PRODUCTION OF I^{132} FROM IRRADIATED URANIUM TETRAFLUORIDE. M. Barrachina Gómez (Junta de Energía Nuclear, Madrid). IAEA Preprint SM-32/41. 21p. (In Spanish)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

A nitric solution of tellurium, containing no fission products that are not isotopic with Te^{132}, is fixed on an alumina column and the I^{132} is removed periodically. The fixation of Te^{132} and the elution of I^{132} were studied and the chemical and radiochemical purity of the product obtained was verified. This method can be used with relatively large quantities of UF_4, which compensates for the poor integral fluxes available in research reactors such as JEN-1, and thus enables sufficient quantities of I^{132}—of the order of 0.5 curies—to be obtained in establishments lacking high-flux reactors in almost continuous operation or unable to irradiate enriched uranium. (auth)

6174 THE CHEMICAL AND PHYSICAL BEHAVIOR OF RELEASED FISSION PRODUCTS. A. W. Castleman, Jr. (Brookhaven National Lab., Upton, N. Y.). 20p. (BNL-6415)

To be published in TID-7641, Proceedings of the Third Symposium on Nuclear Reactor Chemistry, held in Gatlinburg, Tenn., Oct. 9-11, 1962.

It is noted that the release of fission products built up during reactor operation plays an important role in the evaluation of future reactor sites. A study of fission product release from metallic U is considered as a first step toward understanding the fundamental release process. A discussion of experimental studies on the release of I_2, Ce, Ba, La, Mo, and Te from metallic U in purified He and in air is presented. (J.R.D.)

6175 IRRADIATION "FACTOR-DEPENDENCY": EXPLORATORY STUDIES AND IRRADIATION-INDUCED POLYMERIZATION OF STYRENE. Ed. F. Degering (U. S. Army Quartermaster Research and Engineering Center, Natick, Mass.). Preprint. Prepublication Copy. 34p.

An investigation was conducted on the effects of variables on the radioinduced polymerization of styrene and other vinyl monomers. For vinyl monomers, the variable studied was dose rate. For styrene, the variables studied were additive, atmosphere, dose rate, dose level, irradiation or time cycle, traces of O_2 or moisture, and temperature. The additives used were 1% of acrylic acid, vinyl acetate, and methyl acrylate, and the atmospheres studied were air, He, N_2, and vacuum. In all cases, the variables were found to have important effects on the polymerization and on the structure of the polymer. (D.L.C.)

6176 USE OF NUCLEAR FISSION IN SYNTHESIZING ORGANIC COMPOUNDS. Willard P. Conner, Jr. and William E. Davis (to Hercules Powder Co.). U. S. Patent 3,065,159. "Application date Dec. 17, 1957."

A process is described for utilizing fission fragments, in addition to alpha, beta, gamma, and neutron energy, in the synthesis of more complex organic compounds from simple compounds, particularly where such compounds are not normally considered to be mutually chemically reactive. (R.J.S.)

Raw Materials and Feed Materials

6177 (IEA-47) PRODUCÃO DE URÂNIO^{IV} POR REDUÇÃO ELECTROLÍTICA DE SULFATO DE URANILA.

(Production of Uranium(IV) by Electrolytic Reduction of Uranyl Sulfate). Almir Augusto Laranja (Brazil. Instituto de Energia Atômica, São Paulo). May 1962. 35p.

Conditions that can affect the electrolytic reduction of U^{6+} to U^{4+} in uranyl sulfate solutions were studied. With the objective of analyzing the process of electrolysis at the mercury cathode, an attempt was made to establish ideal electrolyte characteristics with additional purification. The kinetics of the process were studied, and the order of the reduction reaction was established. The effects of pH, concentration of the electrolyte, voltage, current density, and geometry of the electrolytic cell were examined. A study on the phenomenon of reoxidation of U(IV), its effect on the yield, and the conditions which avoid it was presented. Finally, an analysis of the yield of the process was made with respect to current efficiency and energy consumed per unit mass of U(IV) produced. (tr-auth)

Separation Processes

6178 (AERE-R-4091) COUNTER-CURRENT LIQUID-LIQUID EXTRACTION IN ANNULUS COLUMNS WITH SHEARING MOTION. R. Spence and R. J. W. Streeton (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Sept. 22, 1952. 56p.

Declassified version of AERE-C/R-933.

The rotary extractor has been investigated both from the point of view of mechanism of operation and from the point of view of utility for the extraction of uranium. It has been shown that there is a hyperbolic relationship between h/d and d/R_1 (where R_1 is the radius of the rotor, d is the width of the annulus, and h is the height of a single vortex). The height of equivalent theoretical stage (H.E.T.S.) varies as the cube root of the cross sectional area (hd) of the vortices and combination of these two relationships gives an expression for the H.E.T.S. in terms of R_1 and d, viz: $H = \text{const.}\ [d^4 + (R_1^2 d^2)/3]^{1/3}$. The expression holds over the whole of the range of sizes studied ($R_1 = 0.075 - 6.66$ cm.; $d = 0.05 - 1.6$ cm.). The rate of transfer of uranyl nitrate across the interface between drops and continuous phase in the butex-aqueous system has been found to depend on the transport of the solvated uranyl nitrate molecule through a solvent film at the interface. The rate of transfer in the case of a single drop in the rotary column is only about twice that which is found for a drop falling freely through a static continuous phase. (auth)

6179 (IA-740) SOLVENT EXTRACTION OF INORGANIC SPECIES. Y. Marcus (Israel. Atomic Energy Commission, Rehovoth). June 1962. 124p.

The literature on the solvent extraction of inorganic species up to the beginning of 1962 is reviewed. Emphasis is given to work published since Diamond and Tuck's review covering the period to 1958. The extraction by chelating agents is outside the scope of the review, as are analytical and other applications. Four hundred and sixty-five references are included. (auth)

6180 (IA-769) SEPARATION OF METALS BY FOCUSING ION EXCHANGE. Y. Yofé, R. Rafaloff, W. Tuler-Magnuszewski, and J. Burg (Israel. Atomic Energy Commission, Rehovoth). Sept. 1962. 16p.

Separation of the mixtures Cu-Ni, Cu-Ni-Co, Ca-La by the focusing ion exchange method was studied. Cu-Ni mixtures can be separated in 6 minutes by the use of tartaric acid, the mixture Cu-Ni-Co in 6 minutes by the use of a mixture of nitrilotriacetic acid disodium salt and tartaric acid at a ratio of 1:10, and Ca-La mixtures in 3 minutes by the use of ethylenediaminetetraacetic acid disodium salt. The focused lines were observed by the colors formed in developing them with an organic developer. For checking the effectiveness of separation the optical density screen method was used. From the surface areas of the curves so obtained the relative amount of each element could be calculated. (auth)

6181 (IA-780) ANION EXCHANGE OF METAL COMPLEXES. THE INDIUM–CHLORIDE SYSTEM COMPARISON OF RESIN AND LIQUID ANION EXCHANGE. Daliah Maydan and Y. Marcus (Israel. Atomic Energy Commission, Rehovoth). Sept. 1962. 18p.

Distribution measurements were made of tracer indium ions between Dowex-1 quaternary ammonium anion exchange resin chloride, and aqueous solutions of sodium chloride. Correcting the distribution data for electrolyte invasion permitted calculation of complex formation parameters for the indium–chloride system. The same set of parameters also describes the liquid distribution data obtained with triisoöctylammonium chloride in xylene and sodium chloride and dilute hydrochloric acid solutions. The species predominant in the resin phase is $InCl_4^-$, those in the liquid amine phases are $RInCl_4$ and R_3InCl_6, depending on concentration. The difference is attributed to differences in the effective dielectric constants of the media. (auth)

6182 (IA-783) ANION EXCHANGE OF METAL COMPLEXES. XIII. THE ACTINIDE(III)–NITRATE SYSTEM. Y. Marcus and M. Givon (Israel. Atomic Energy Commission, Rehovoth). Oct. 1962. 14p.

Anion exchange distribution data were obtained for a number of trivalent actinide ions (Pu, Am, Cm, Ci, and Es) in lithium nitrate solutions. The distribution coefficients are comparable with those of the lanthanide group, so that no group separation is possible, but within the actinide group, an efficient separation of americium and curium was found. Extraction behavior by long chain amines followed that of the lanthanides, but in reverse atomic number order. A second power dependence of distribution coefficients on amine concentration was found. (auth)

6183 (IS-423) SEPARATION OF IRON BY LIQUID-LIQUID COLUMN EXTRACTION. James S. Fritz and C. E. Hedrick (Ames Lab., Ames, Iowa). [Feb. 15, 1962]. Contract [W-7405-eng-82]. 18p.

Iron(III) can be separated from many elements by extraction from 6 to 8M hydrochloric acid. The extraction is carried out by passing the aqueous hydrochloric acid solution through a column packed with 2-octanone adsorbed onto a polyfluorocarbon resin. Fluoride, phosphate, sulfate, or citrate cause no interference. Traces of iron(III) can be separated quantitatively from large amounts of copper(II) or zinc(II); traces of titanium(IV) can be separated from large amounts of iron(III). (auth)

6184 (NBS-7582) METALLIC REACTIONS IN URANIUM RECOVERY. Summary Report. John J. Park (National Bureau of Standards, Washington, D. C.). Aug. 2, 1962. 21p.

A pyrometallurgical approach to uranium recovery is described. The formation of compounds, hydriding procedures, amalgamation procedures, ternary alloys, quinary alloys, quenched specimens, and zinc alloy systems are discussed. (M.C.G.)

6185 (ORNL-2056) THOREX THORIUM NITRATE PRODUCT SPECIFICATIONS. E. D. Arnold and R. P. Wischow (Oak Ridge National Lab., Tenn.). May 24, 1956. Contract W-7405-eng-26. 41p.

Activity and ionic impurity specifications are presented for Thorex thorium nitrate products. Two sets of specifications are given, one set for direct handling during refabrication of production reactor thorium metal slugs and the second for refabrication of future power reactor thorium metal elements by semi-remote technics. Consideration was given to the health hazard problems associated with each process step between the Thorex process and final refabricated source material in order to arrive at these specifications. (auth)

6186 (ORNL-TM-420) AQUEOUS PROCESSING OF THORIUM FUELS. PART II. R. E. Blanco, L. M. Ferris, C. D. Watson, and R. H. Rainey (Oak Ridge National Lab., Tenn.). Nov. 27, 1962. Contract [W-7405-eng-26]. 56p.

The status of aqueous processing methods for Th fuels is reviewed. A specially designed 320 ton shear was successfully tested for chopping full size simulated Consolidated Edison type unirradiated assemblies into 0.25-1.5 in. lengths. Pieces about 0.5-in. long are preferred since the core pellets are more severely crushed during the chopping operation, and consequently, the rate of core dissolution is enhanced. The Darex (dilute aqua regia) and Sulfex (4 to 6 M sulfuric acid) processes for dissolution of stainless steel claddings were developed on a small engineering scale with unirradiated fuel. In hot cell tests on stainless steel clad ThO_2-UO_2 fuel pins irradiated up to 22,000 Mwd/ton of fuel, the core pellets were severely fractured and losses of U and Th to the Sulfex and Darex solutions were ~0.3% and 3 to 5%, respectively. The latter losses are easily recovered in the extraction system. U and Th can be recovered from graphite base fuels by burning and dissolution of the ash in HNO_3 or by grinding to ~200 mesh followed by HNO_3 leaching. The Acid Thorex extraction process was developed to recover both U and Th using tributyl phosphate (TBP) as the solvent and the Acid Interim 23 process to recover only the U using either TBP or disecbutyl phenyl phosphate as the solvent. The "Acid" processes use HNO_3 rather than Al as the salting agent. (auth)

6187 (TID-14598) THE ANION-EXCHANGE SEPARATION OF PLUTONIUM AND THORIUM. D. B. James and E. L. Christensen (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 16p. (LADC-5191)

The use of anion exchange from strong nitrate solutions for the purification of Pu has been quite successful, largely because the method is highly specific for Pu. However, the method fails for Pu–Th mixtures since both elements are strongly sorbed. Plutonium(IV) is also strongly sorbed by anion-exchange resin from strong HCl solution, but Th(IV) is not sorbed from any concentration of HCl. This allows these elements to be separated with one sorption-desorption of the Pu. The optimum conditions in the feed solution are 7 to 8M HCl, 25 ± 10 g Pu/l, any percentage of Th and $0.1 > M\ HNO_3 < 3$. The method was successfully tested on a pilot-plant scale using 60 g of Pu per run. The product solutions contained 20 to 40 g Pu/l, ~1 M HCl and <10 ppm of Th in the Pu. One run with a plant-scale system, designed to handle 400-g batches of Th contaminated Pu, has successfully produced a <30 ppm product. (auth)

6188 (TID-15271) SYNERGISTIC EFFECTS IN THE EXTRACTION OF SELECTED METALLIC CATIONS BY MONO (2-ETHYL HEXYL) PHOSPHORIC ACID. G. W. Mason, S. McCarty, and D. F. Peppard (Argonne National Lab., Ill.). Dec. 1961. Contract [W-31-109-eng-38]. 33p. (UAC-5922)

The effect of synergistic agents upon the extraction of M(III) lanthanides, Y(III), Am(III), Cm(III), Th(IV), and U(VI) by H_2MEHP, mono 2-ethyl hexyl phosphoric acid, in a carrier diluent from aqueous HCl was investigated as a function of carrier diluent, synergistic agent, concentration of H_2MEHP and Z of M(III) lanthanides. It was found that a plot of log K vs log (r-0.5) or log (r-2), depending upon the synergist, is more meaningful than a plot of log K vs F or log F of the synergist, where r is the ratio, (F of synergist/F of H_2MEHP). For some elements as r increased from zero, K rose to a maximum (region of positive synergism); in others no positive synergism was noted. In each instance in which a maximum was found, the maximum became progressively more pronounced as the synergist was varied from n-decanol to TBP (tri-n-butyl phosphate) to TOPO (tri-n-octyl phosphine oxide). In the negative synergism range, the limiting slope of the log K vs log (r-0.5) plot for all of the M(III) examples studied (TBP synergist and cyclohexane and toluene diluents) was −3. Similarly, the limiting slope of the log K vs log (r-2) plot (n-decanol synergist and cyclohexane diluent) was −3 for M(III), −4 for Th(IV), and −2 for U(VI). The extractant dependency for Eu(III) and Am(III) by H_2MEHP in the absence of synergist is shown to be first power in toluene diluent and third power in n-decanol diluent. Z-studies in the diluents toluene, cyclohexane, and n-decanol are included. Tentative explanations of the negative synergistic effects are proposed in terms of assumed chemical interaction between synergist and H_2MEHP; and possible applications of these effects are suggested. (auth)

6189 (TID-15313) EXTRACTION OF Th(IV) AS A MIXED COMPLEX, NITRATE OR CHLORIDE, BY 2-ETHYLHEXYL HYDROGEN 2-ETHYLHEXYL PHOSPHONATE. D. F. Peppard, M. N. Namboodiri, and G. W. Mason (Argonne National Lab., Ill.). Jan. 1962. Contract [W-31-109-eng-38]. 25p. (UAC-6016)

The extraction of Th(IV) from aqueous perchlorate, chloride and nitrate aqueous phases into a solution of an acidic phosphonate, generally represented as (GO) (G) PO (OH), dissolved in a carrier diluent is reported. Specifically, 2-ethylhexyl hydrogen 2-ethylhexyl phosphonate, (EHO) (EH) PO (OH), dissolved in toluene was employed as the extractant phase. From a nitrate phase, Th(IV), in tracer level concentration, was extracted as two mononuclear species containing one and two nitrate groups per atom of Th(IV), respectively. The extraction of the two-nitrate entity was favored, with respect to that of the one-nitrate entity, as the acidity of the aqueous phase increased. The K for each of these species appeared to be third-power dependent upon the concentration of the (EHO) (EH) PO (OH), which is dimeric in the diluent employed. The extraction of a nitrate-free entity was negligible under the conditions of the investigation. In saturation experiments, the empirical composition of the extract, as determined by gross analyses, was $Th(NO_3)_{1.9}(EH[EHP])_{2.2}$. From a chloride phase, the extract in tracer-level studies contained a chloride-free and a one-chloride species. The K values for these two species were third-power and 2.5-power extractant dependent, respectively. In saturation experiments, the empirical composition of the extract, as determined by gross analyses, was $Th(Cl_{0.9}(EH[EHP])_{2.9}$. The perchlorate behavior paralleled that of the chloride system, except that the extractant dependency is third-power. The empirical composition of the extract, in saturation experiments, was $Th(ClO_4)_{0.4}(EH[EHP])_{3.7}$. (auth)

6190 (AEC-tr-5574) THE SOLUBILITY OF INORGANIC SALTS IN ORGANIC SOLVENTS AND IN THEIR

MIXTURES WITH WATER. I. (E.) S. Pekhtashev and S. A. Voznesenskii. Translated for Ames Lab., Ames Iowa from Izv. Vysshykh Uchebn. Zavedenii, Khim. i Khim. Tekhnol., 2: 827-33(1959). 10p.

The solubilities of the nitrates and sulfates of cesium and strontium in a series of organic solvents of a different chemical nature and in their mixtures with water were measured. It was found that in practically all cases for aqueous mixtures with a high percentage of water (above 50%) the logarithm of the solubility depended linearly on the inverse value of the dielectric constant of the solvents. (auth)

6191 (CEA-tr-R-1514) LES PROPRIÉTÉS DES SOLUTIONS NITRIQUES DU PLUTONYLE. II. FORMATION DE COMPLEXES DU PLUTONYLE DANS LES SOLUTIONS NITRIQUES. (Properties of Nitric Solutions of Plutonyl. II. Formation of Plutonyl Complexes in Nitric Solutions). M. E. Krevinskaya, V. D. Nikol'skii, and B. G. Pojarskii. Translated into French from Radiokhimiya, 1: 554-61(1959). 23p.

Plutonyl absorption spectra were studied as a function of the concentration of nitric acid in order to determine the composition of complexing anions. An attempt was made to estimate the equilibrium constant in complexing reactions. (R.V.J.)

6192 (EURAEC-382) REPROCESSING OF IRRADIATED FUELS. 5th Quarterly (second year), April 1 to June 30, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucléaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 049-61-4 RDB. 25p. A translation.

Development of a process for one-step chlorination of U_3O_8 to UCl_6 is reported. Research on the selective fixation of fission products was continued. A study of UO_2 monocrystal oxidation revealed the effects of defects on the process. These defects appear to promote leaching and cause cleavage. Work on corrosion of Nb by reagents used in reprocessing was initiated. (J.R.D.)

6193 TREATMENT BY ION EXCHANGE OF NATURAL LEACHING SOLUTIONS OF URANIUM MINERALS. J. Estrada Aguilar and A. Uriarte Hueda (Junta de Energia Nuclear, Madrid). Energia Nucl. (Madrid), 6: 43-54(Apr.-June 1962). (In Spanish)

In the area of Salamanca and Albuquerque in Spain there is a U mineral that is easily leached by simply washing with water. Ion exchange procedures, among others, have been used for the recovery of uranium from the solutions. The results obtained in the treatment of these solutions by ion exchange and the recovery of the uranium as the sodium diuranate are reviewed. (J.S.R.)

6194 THE MECHANISM OF EXTRACTING SOME CESIUM COMPOUNDS FROM WATER TO NITROBENZENE. Miroslav Kyrš. Jaderna Energie, 8: 400-1(Nov. 1962). (In Czech)

The results of an investigation of cesium extraction in the presence of dipicrylaminate, tetraphenylborate, polyiodide, and iodobizmuthite into nitrobenzene are interpreted. In all cases studied, nitrobenzene yielded the highest partition coefficients of all other solvents tested. For sodium and the respective anions, higher partition coefficients were obtained, when some other, less polar, solvents were used. The separation factor for the pairs $Cs^+ - Na^+$ ($\sim 2.10^3$) and $Cs^+ - Rb^+$ (~ 5) are practically independent on the kind of anion present. An essential dissociation of the cesium salts used in the nitrobenzene was found. It is maintained that cesium ions are strongly solvated by nitrobenzene molecules (stronger than sodium). The principal reaction of the extraction mechanism is the following: $Cs^+_{(aq)} + A^-_{(aq)} \rightleftharpoons Cs^+_{(org)} + A^-_{(org)}$. It is felt that a sufficient property of the salt, enabling a reasonable cesium extraction into nitrobenzene, is to yield a reasonably high concentration of free anions in nitrobenzene phase. Views on the mechanism of the extraction are confronted with other experimental evidence. (auth)

6195 INERT DILUENTS FOR USE IN NUCLEAR ENERGY EXTRACTION PLANTS. I. VAPOUR-PHASE CHROMATOGRAPHY OF SELECTED SOLVENTS. D. A. Landsman and E. S. Lane (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). J. Appl. Chem. (London), 12: No. 1, 24-33(Jan. 1962).

The conversion of a commercial vapor fractometer to operate with capillary columns is described. The apparatus was used with a squalane stationary phase p at 100°, to examine several kerosene-type solvents which have already been used, or which might be used in the future, as inert diluents for TBP extraction systems. Several chromatograms, which serve to demonstrate the remarkable potentialities of capillary columns and ionisation detectors for work of this nature, are presented and discussed. (auth)

6196 THE EXTRACTION OF URANIUM (VI) FROM SULPHURIC ACID SOLUTIONS BY DI-(2-ETHYLHEXYL)-PHOSPHORIC ACID. Taichi Sato (Government Chemical Industrial Research Inst., Tokyo). J. Inorg. Nucl. Chem., 24: 699-706(Nov. 1962).

The partition of uranium(VI) between sulfuric acid solutions and solutions of di-(2-ethylhexyl)-phosphoric acid (DEHPA) in kerosene was investigated at varying concentrations of sulfuric acid, solvent, and uranium at different temperatures. Changes in acidity of the organic solutions were examined, and infrared data were obtained; the mechanism of uranium extraction is discussed on the basis of the results. (auth)

6197 THE EXTRACTION OF METALLIC SPECIES BY DIALKYLPHOSPHORIC ACIDS. C. F. Baes, Jr. (Oak Ridge National Lab., Tenn.). J. Inorg. Nucl. Chem., 24: 707-20(Nov. 1962).

A review is given on mono-dialkylphosphates as solvent extraction reagents for the separation of metallic species. Discussion is given on the solvent effect on reagent association and extraction, reagent structure, and ion size, charge, and loading. The extraction of various cations at low concentrations by di(n-butyl)- and di(2-ethylhexyl) phosphoric acids is tabulated. (P.C.H.)

6198 EXTRACTION OF URANIUM FROM SOLUTIONS OF COMPLEX URANYL CARBONATE BY CETYL-DIMETHYL-BENZYL-AMMONIUM CHLORIDE. M. T. Sardiña, R. F. Cellini, and T. Batuecas Rodriguez (Junta de Energia Nuclear, Madrid). J. Inorg. Nucl. Chem., 24: 721-8(Nov. 1962).

The behavior of the cetyl-dimethyl-benzyl-ammonium chloride (CDMBA) in the extraction of uranium dissolved in a carbonate medium was studied on a laboratory scale. The effect of a certain number of variables on the extraction factor was determined. The variables considered included: the amount and concentration of CDMBA, carbonate and bicarbonate concentrations, uranium concentration, temperature, contact time, and variations in the composition of the diluent. It was found that, in the case of a uranium concentration of 1 g/l, the amount of uranium extracted in a single stage was as high as 94.4 per cent of the total if the concentration of CDMBA was 0.034 M and 98 percent if CDMBA 0.050 M was used. (auth)

6199 FUEL REPROCESSING PLANTS IN EUROPE. D. Thiele (Kernreaktor Bau- und Betriebsgesellschaft m.b.H., Karlsruhe, Ger.). Kerntechnik, 4: 586-7(Dec. 1962). (In German)

A summary is given on reprocessing plants already in operation and in design. The processes applied in the respective cases are briefly described. (auth)

6200 SEPARATION OF In AND Sn WITH ALKYL PHOSPHORIC ACID SOLUTIONS. I. S. Levin. Zh. Prikl. Khim., 35: 2368-79(Nov. 1962). (In Russian)

Solvent extraction of In and Sn from HCl, H_2SO_4, and $HClO_4$ and from $HClO_4$, HNO_3, and $H_2C_2O_4$ HF by alkyl phosphoric acid was analyzed. The extraction of In and Sn from sulfuric acid is followed by elution of Sn^{2+} from an organic phase of 800 to 1000 g/l and elution of Sn^{4+} by HF 1:3. In is re-extracted in 9 to 10N HCl (0:B ≈ 80 to 100:1). An attempt was made to separate In and Sn at Sn:In = 5000:1 and to determine the effects of temperature and metal concentration on the separation. The electrolytic extraction scheme for Sn–In hydrates is included. (R.V.J.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

6201 (ANL-FGF-300) ULTRASONIC "JACK HAMMER" DEVELOPMENTS. Warren J. McGonnagle (Argonne National Lab., Ill.). Sept. 11, 1961. Contract [W-31-109-eng-38]. 6p. (UAC-5624)

A machine is described for use in making ultrasonic jack hammer styli. A number of styli can be made simultaneously using this machine. Other developments include adaptation of the jack hammer (used for removing microscopic inclusions) for remote operation. (J.R.D.)

6202 (BMI-X-216) DESCRIPTION OF AN IN-PILE FISSION GAS RELEASE APPARATUS. James B. Melehan (Battelle Memorial Inst., Columbus, Ohio). Dec. 27, 1962. Contract W-7405-eng-92. 12p.

An apparatus was designed for irradiation of nuclear fuels and for collection and analysis of radioactive fission gas released during irradiation. The fissionable material is exposed to neutron radiation in a nuclear reactor at various temperatures while a purified carrier gas enveloping the irradiation specimen entrains the released fission gases and transports them to a fission gas collection apparatus. The abundances of collected fission gases are determined by gamma spectrometry. (M.C.G.)

6203 (BNL-5820) HOT CELL LAYOUT CRITERIA. John M. Ruddy (Brookhaven National Lab., Upton, N. Y.). Sept. 1961. Contract [AT-30-2-GEN-16]. 11p.

The space relationships requiring consideration for "hot" cell complexes are those between "cold," "semi-hot," and "hot" areas which are the operating, the charging and service areas, and the "hot" cell itself. The use of each type of space must be considered as to openness, modular layout, height adequacy, structural capacity, and flexibility for future changes. The basic layout criteria for planning is different between beta-gamma and alpha-gamma cell complexes because of contamination in the latter from radioactive materials. Beta-gamma cell complexes will, in general, be either irradiation cells and radioisotope handling cells, neither of which are normally subject to contamination. Alpha-gamma cell complexes have all of the radiation problems of beta-gamma cells plus the probability of radioactive contamination whether they are for radioisotope or mixed fission product handling. The criteria affecting cell size and access, ancillary space type and size, general cell complex access and traffic, and personnel and radiation control are defined for both complexes plus contamination control for alpha-gamma cell complexes. The difference between production type and experimental cells is described for all types of cells. (R.J.S.)

6204 (BNL-5850) DESIGN AND FABRICATION OF METAL WORK FOR TWO HIGH INTENSITY RADIATION EXPERIMENTAL CELLS. John M. Ruddy (Brookhaven National Lab., Upton, N. Y.). [Dec. 1961]. Contract [AT (30-2)-Gen-16]. 12p.

Metal work required in the construction of a hot cell is discussed. Two hot cells built for fundamental and development research work in the field of the effects of large quantities of ionizing radiation on substances packaged and unpackaged are described. (M.C.G.)

6205 (CERN-62-28) THE CERAMIC SPRAYMAT. A FLAME SPRAYED CERAMIC-METAL HEATING ELEMENT FOR THE HEATING OF METALLIC WALLS OF VACUUM CHAMBERS FOR ACCELERATED OUTGASSING. A. H. Achermann (European Organization for Nuclear Research, Geneva). Oct. 2, 1962. 17p.

The application of a heating element which is sprayed directly on the component to be heated for heating walls of a vacuum vessel in order to accelerate outgassing is discussed. The Ceramic Spraymat consists of a pattern of sprayed metal heating elements embedded between two layers of ceramic insulation. The natural adhesion of the base insulating layer permanently bonds the heater mat to the metal wall of the vacuum chamber. The Spraymats subjected to a fatigue test withstood 10.2×10^7 cycles at a maximum strain of ± 0.0075 cm/cm. Pure Al_2O_3 and combined Al_2O_3 and Cr_2O_3 were used as insulation. Nickel-chrome heating elements and busbars of either copper or silver were tested. The specified lifetime was successfully exceeded. (M.C.G.)

6206 (SCTM-219-62(73)) VECTOR-FOLLOWING CENTRIFUGE FIXTURES. J. C. Krimmell (Sandia Corp., Albuquerque, N. Mex.). Oct. 1962. Contract [AT(29-1)-789]. 26p.

The results are reported of some theoretical investigations into the feasibility of two proposed operating principles for centrifuge fixtures intended to follow the centrifuge resultant acceleration vector; that is, fixtures to which test specimens could be mounted in order to reduce lateral accelerations during short duration acceleration pulses, taking advantage of both acceleration components. (auth)

6207 (TRG-Report-294) A NUMERICAL SOLUTION OF THE END DEFORMATION PROBLEM OF CYLINDERS. W. R. Hodgkins (United Kingdom Atomic Energy Authority. Reactor Group, Springfields, Lancs, England). May 22, 1962. 17p.

A method is described of determining the elastic stress and strain in a long cylindrical bar resulting from the application of an axially symmetric distribution of surface forces applied near the ends. The results of a few particular problems are given and the results shown to be in agreement with St. Venant's principle. (auth)

6208 (XDC-61-3-66) FINAL PROGRAM REPORT FOR A HIGH TEMPERATURE, REMOTELY HANDLEABLE CABLING SYSTEM. G. A. Gallant (General Electric Co. Missile and Space Vehicle Dept., Burlington, Va.). Aug. 22, 1960. Contracts AF33(600)-38062 and AT(11-1)-171. 168p.

Design and manufacturing considerations and evaluations are described for a high-temperature electric cabling system which can be handled by remote manipulators. A cabling system for remote use at 590°F can be successfully designed and manufactured; however, weight, size, and performance of these systems cannot be comparable with lower-temperature systems. Because of material limitations, size and weight of both the cabling and connectors are necessarily larger than lower-temperature systems. The flexibility of the cabling, while adequate, is not equal to conventional cabling. Metal "O" ring moisture seals are effective for extended periods of time; however, they will not keep out moisture for indefinite periods of time. (auth)

6209 CURRENT-CARRYING CAPACITY OF SUPERCONDUCTING Nb–Zr SOLENOIDS. D. Bruce Montgomery (Massachusetts Inst. of Tech., Cambridge). Appl. Phys. Letters, 1: 41-3(Oct. 1962).

Explanation of the discrepancy between Nb–Zr short sample tests and solenoid performance and prediction of

the current carrying capacity of Nb–Zr solenoids are based on the mechanism of induced persistent-eddy currents. Study of residual fields following reduction of magnetic field strength to zero leads to assumptions permitting calculations of circulating current magnitudes. Data are presented graphically, and generation of the same field using less material is found to result from spreading out layers or turns. (D.C.W.)

6210 AIR TIGHTNESS OF NUCLEAR VESSELS AND BUILDINGS. Maria Alicia Crespi (Junta de Energia Nuclear, Madrid). Energia Nucl. (Madrid), 6: 32-42(Apr.-June 1962). (In Spanish)

The concept of air tightness is first defined, and the necessity of air-tight structures for nuclear reactors is reviewed. The relation of tightness with the reactor class and location is then reviewed. Types of air-tight structures and their degree of tightness are described. The degree of tightness of structures involving reactors is considered. (J.S.R.)

6211 MINIMUM-WEIGHT PROPORTIONS OF PRESSURE-VESSEL HEADS. G. A. Hoffman (RAND Corp., Santa Monica, Calif.). J. Appl. Mech., 29: 662-8 (Dec. 1962).

The minimum-weight shapes of head closures are derived, for cylindrical pressure vessels. Head configurations, weights, and membrane stresses are obtained for thin-shell heads of isotropic materials with uniform internal pressure by restricting the knuckle shear stresses to constant values where possible and by minimizing the weight of prescribed-shape heads. Torispherical, ellipsoidal, and Biezeno-type heads with constant and varying thickness (neglecting the effects of bending) are investigated. Enclosed-volume constancy and supporting structures are also considered. Certain highly efficient shapes are obtained that weigh up to 11 per cent less than the corresponding hemispherical capping closure. (auth)

6212 A HIGH TEMPERATURE FURNACE FOR STUDIES OF THE MECHANICAL PROPERTIES OF MATERIALS UP TO 2100°C. D. R. Axelrad (Univ. of Sydney). J. Sci. Instr., 39: 640-1(Dec. 1962).

A new high-temperature furnace of the resistance type employing graphite resistors is described. This furnace can be used for the performance of tension, compression, or torsional load tests on materials for test zone temperatures up to 2100°C. (auth)

6213 TROLLEY FOR RADIOACTIVITY MEASURING EQUIPMENT. G. R. A. Padmore and F. Ramsden (Royal Infirmary, Preston, Lancashire, Eng.). Lancet, 1: 344 (Feb. 11, 1961).

Construction of a trolley, which supports 2 scintillation counters for use with radioiodine uptake studies of the thyroid, is described. (H.H.D.)

6214 A MODIFICATION OF THE DEVICE FOR OPENING THE METAL CONTAINER WITH RADIOACTIVE ISOTOPES. F. M. Lyass and V. M. Desyatnikov. Med. Radiol., 7: No. 11, 75-6(Nov. 1962). (In Russian)

A design is given of a remote-control ampule opening device for handling isotope containers. (R.V.J.)

6215 PLOWSHARE. A PROGRAM FOR THE PEACEFUL USES OF NUCLEAR EXPLOSIVES. David B. Lombard (Univ. of California, Livermore). Phys. Today, 14: 24-34(Oct. 1961). (UCRL-6081(Rev.))

The purpose of Project Plowshare is described briefly, and some of the results of the Rainier explosion are discussed. Some of the possible applications of nuclear explosions being considered by the Plowshare group are discussed. The Plowshare nuclear experiments Gnome and Chariot are described, and the use of explosives in excavation is discussed. New scaling relations for crater dimensions are given. Other applications of explosions are block caving with completely contained explosions, recovering petroleum from oil sand and oil shale, and replenishment of underground water resources. The use of explosions for carrying out chemical reactions is discussed briefly. (D.L.C.)

6216 FAST GAS VALVE FOR PLASMA RESEARCH. R. S. Lowder and F. C. Hoh (Advanced Kinetics, Inc., Costa Mesa, Calif.). Rev. Sci. Instr., 33: 1236-8(Nov. 1962).

A new type of fast gas valve was developed for plasma experiments requiring a rapid injection of gas into a vacuum. The valve can be opened and closed within 70 μsec and the gas injection is highly reproducible. A fast opening and closing of the valve, which consists of a low weight aluminum disk sealing against a soft O-ring, is achieved by energizing a coil placed on the O-ring side of the disk and allowing the disk to hit a nearby piece of aluminum and bounce back onto the O-ring. The density distribution of the expanding gas in the vacuum region near the valve was mapped out at particular times shortly after the opening of the valve by using a fast gas gage. Comparative measurements with a spring-loaded valve showed the present valve to have a shorter opening time and much better reproducibility. (auth)

6217 TRIGGERING MECHANISM OF LOW-PRESSURE SPARK GAPS. R. Hancox (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). Rev. Sci. Instr., 33: 1239-44(Nov. 1962).

The triggering delay in two low-pressure spark-gap switches, operating in the pressure range 10^{-3} to 3×10^{-2} mm Hg, was measured under a wide range of conditions. When the trigger pin is in the negative electrode, the delay is found to consist of two components. The first part depends on the construction of the trigger pin, the trigger voltage, and the impedance of the trigger circuit, while the second part depends on the nature and pressure of the gas in the gap, and the voltage and impedance of the circuit being switched. If the trigger pin is in the positive electrode a further delay is added which is approximately equal to the transit time of an ion across the gap. A mechanism for the breakdown is proposed which is consistent with the measurements and with previously reported results. (auth)

6218 ELECTRON CLOUD ANNEALING FURNACE. B. S. Chandrasekhar and P. A. Flinn (Westinghouse Research Labs., Pittsburgh). Rev. Sci. Instr., 33: 1247-8 (Nov. 1962).

An electron bombardment annealing furnace was constructed for annealing refractory metal samples in high vacuum up to about 2800°C. The furnace is designed to accept small rods or plates, not over about 3 in. in the largest dimension. Provision is included for quenching in water (or other liquid) directly from the annealing temperature. The maximum power input to the sample is about 600 w. (auth)

6219 POWER SUPPLY AND CONTROL CIRCUIT FOR ION-GETTER PUMPS. Gilbert C. Ford and Virgil W. Vail (Northwest Nazarene Coll., Nampa, Idaho). Rev. Sci. Instr., 33: 1286-7(Nov. 1962).

A power supply and a control circuit for small ion-getter vacuum pumps was developed for reading the pressure reproducible to 10^{-10} Torr and indicating the pressure to 10^{-11} Torr. A d-c amplifier with 100% negative feedback is used to read the small pump current (0.01 μa at 10^{-10} Torr) with an ordinary 0 to 1 ma meter. (D.L.C.)

6220 IMPROVED DIFFRACTOMETER RADIATION SHIELD. J. S. Wollam (General Electric Co., Schenec-

tady, N. Y.). Rev. Sci. Instr., 33: 1288-9(Nov. 1962). (TID-16140)

The gaps in the hinged shield used in many commercial x-ray diffractometers may be covered with a second hinged shield. The design of the second shield is described. (D.L.C.)

6221 "VACUUM SENTINELS" FOR PREPARATIVE ANALYTIC ULTRACENTRIFUGES. F. T. Lindgren and F. T. Upham (Univ. of California, Berkeley). Rev. Sci. Instr., 33: 1291-2(Nov. 1962). (UCRL-10400)

A "vacuum sentinel" circuit was devised for turning off a Spinco model E or L ultracentrifuge in case of vacuum loss or cell leakage. Thus, the ultracentrifuge is stopped before the sample is lost or the centrifuge is damaged. (D.L.C.)

6222 EFFECTS OF SURFACE HEAT TRANSFER ON THE PERFORMANCE OF A THERMOELECTRIC GENERATOR. L. J. Ybarrondo and J. E. Sunderland (Northwestern Univ., Evanston, Ill.). Solid-State Electron., 5: 143-54(May-June 1962).

Analytical solutions are given for the steady-state temperature distribution, power output, and efficiency of a thermoelement which is used in a thermoelectric power generator. The longitudinal surface of the thermoelement is divided into three regions. The first region is exposed to convection with the environment at the cold junction; the second region is thermally insulated; the third region is exposed to convection with the environment at the hot junction. The relative sizes of the three regions are variable. The solutions are useful for predicting the performance of thermoelectric power generators and for showing the improvements in performance that can be gained through the use of surface heat transfer. It is shown that substantial increases in the power output can be gained if the thermoelements are exposed to surface heat transfer. It is possible to use surface heat transfer to reduce greatly the amount of fin surface needed at the hot and cold junctions. A numerical example is presented in which no fins are used at the hot and cold junctions; it is shown in this example, that, by using surface heat transfer, 97 per cent of the maximum theoretical output can be achieved. (auth)

6223 TEST METHOD FOR DETERMINATION OF CARBON PAPER TRANSFER CHARACTERISTICS. C. C. Thomas, Jr., D. M. Hart, and R. F. Horan (Quantum Inc., Wallingford, Conn. and Moore Business Forms, Inc., Niagara Falls, N. Y.). IAEA Preprint SM-32/18. 17p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

One type of card in large scale use in the data processing field has information imprinted on the card with carbon paper. The transfer of a portion of this image to the data processing equipment (such as card sorters) can cause malfunction of the machines. In addition, re-transfer to the cards can result in loss of legibility. A test method for evaluation of carbon paper ink formulations that would yield data on transfer characteristics with a minimum of test samples under dynamic conditions is discussed. A radiotracer test method has been developed which adequately fills the test requirements. The method consists, essentially, of activation of the carbon paper, imprinting the tab cards, and processing the cards through a standard card sorter. The detection system consists of a shielded GM tube mounted over one wheel of the card sorter, a counting rate meter with a fast response time, a high speed strip chart recorder and associated power supplies. (auth)

6224 IMPROVEMENTS RELATING TO THE IRRADIATION OF SPHEROIDAL BODIES. Donald George Marshall and Roy Axe (to Dunlop Rubber Co. Ltd.). British Patent 912,653. Dec. 12, 1962. Filed Apr. 23, 1958.

A spheroidal body is caused to roll along a track or tracks and is rotated about each of two or more symmetrically disposed diametral axes in the body while the body is exposed to ionizing radiation. The rotation about each axis is at least sufficient to expose the whole circumference of the body to the radiation in a plane perpendicular to the axis involved. (R.J.S.)

6225 NUCLEAR REACTOR STEAM GENERATING PLANT. Harold John Coles and Graham William Sneddon (to Mitchell Engineering Ltd.). U. S. Patent 3,068,164. "Priority date May 4, 1959, England."

An apparatus is described for use in a steam generating plant that includes a nuclear reactor as the heat source. The apparatus is designed for removing non-condensable gases from the plant and is comprised of a catalyst chamber to effect recombination of the non-condensable gases, a superheating device, and feed means arranged to conduct steam from the plant together with non-condensable gases, successively to the superheater and thence to the catalyst chamber. (R.J.S.)

6226 ELECTRON BEAM FURNACE WITH MULTIPLE FIELD GUIDANCE OF ELECTRONS. Charles W. Hanks (to Stauffer Chemical Co.). U. S. Patent 3,068,309. "Application date June 22, 1960."

This electron beam furnace provides separate electron guns for directing bombarding electrons upon bar stock to be melted and into the pool of molten material in the container or mold. The provision of separate guns provides a maximized degree of control over furnace operations. It is also possible to achieve a very high energy deposition from electron beam bombardment without exceeding normal electron gun output. (R.J.S.)

Heat Transfer and Fluid Flow

Refer also to abstracts 6401, 6640, 6650, 7528, and 7613.

6227 (ANL-6633) CONTRIBUTION TO THE THEORY OF TWO-PHASE, ONE-COMPONENT CRITICAL FLOW. Hans K. Fauske (Argonne National Lab., Ill.). Oct. 1962. Contract W-31-109-eng-38. 174p.

Equipment was built where critical-flow data above 100 psia were obtained and a theory developed that predicts the experimental values satisfactorily. Theoretical expressions for the specific volume, void fraction, and slip ratio for critical steam–water mixtures have been derived. Therefore, the first complete analytical solution was made possible for estimating the critical two-phase flow rate, including slip between the two phases. The pressure profiles for runs at critical flow were all characterized by extremely steep pressure gradients near the throat; however, the pressure gradients are definitely finite and approach absolute maximum values, these depending only upon critical flow rate and quality. Sonic velocities are not achieved in critical two-phase flow of steam–water mixtures. Therefore, the phenomenon of two-phase critical flow differs significantly from that of single-phase critical flow. A new theory has been postulated in an effort to explain the mechanism of two-phase critical flow. The geometry of the system to be investigated has apparently no effect on the critical-flow phenomenon for the diameters and lengths of pipes used in this work. The experimental data obtained compare favorably with previous investigations in

the range of variables where such a comparison is possible. The "Homogeneous Flow Model" is found to be unsatisfactory for all critical throat pressures and qualities examined. The assumption of no slip between the phases, therefore, can be said to be definitely incorrect. Since the theory presented describes the critical phenomenon satisfactorily for all pressures and qualities examined so far, and no parameters depending on experimental values are needed, the theory is believed to be highly valuable in determining the maximum discharge of steam–water mixtures from conduits and "breaks" in vessels and pipes. The applications are subjects of considerable concern in the evaluation of nuclear reactor accidents and containment among others. (auth)

6228 (BNL-6177) WALL AND BULK TEMPERATURES FOR FLUIDS FLOWING IN CONCENTRIC ANNULI. O. E. Dwyer (Brookhaven National Lab., Upton, N. Y.). May 28, 1962. Contract [AT(30-2)-Gen-16]. 11p.

An analysis of radial temperature differences for heat transfer to fluids flowing through concentric annuli is presented. Conditions and assumptions used in the analysis include a constant heat flux, fully established turbulent flow, heat transfer through the inner wall only, and physical properties independent of temperature. (J.R.D.)

6229 (SCTM-233-62(14)) TRANSIENT HEAT TRANSFER IN MICROMODULES. L. W. Oline and P. M. Barba (Sandia Corp., Albuquerque, N. Mex.). Nov. 1962. Contract [AT(29-1)-789]. 17p.

Heat dissipation in a typical micromodule package is considered. A temperature history for every element in the package is obtained for various heat inputs. The approach used is to approximate the package by a network of heat storage nodes and heat conduction paths. The differential equations based on this heating system were solved using the Herman Heat Transfer Program for the CDC 1604 Digital Computer. (auth)

6230 (TID-14550) PIC METHOD FOR FLUID DYNAMICS CALCULATIONS. Francis H. Harlow (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 50p. (LADC-5170)

A discussion of the particle-in-cell method (PIC) for numerical solution of problems involving the dynamics of compressible fluids is presented. The features especially desired during development of PIC were those of allowing large distortions to occur in the fluid without reducing the calculations to nonsense, and of having the capability of calculating the history of each element of the fluid. The general features of the PIC method are described and an example of the method is given along with discussions of boundary conditions and generalizations, properties of the computing method, and shock-wave refraction at a gaseous interface. (J.R.D.)

6231 TRANSFER FUNCTIONS OF HEAT EXCHANGERS. James P. Hsu (IBM Corp., Chicago) and Nathan Gilbert. A.I.Ch.E. (Am. Inst. Chem. Engrs) J., 8: 593-8(Nov. 1962).

Transfer functions, obtained by straightforward and rigorous procedures of mathematical analysis, are given for heat exchangers. They are valid under the assumptions underlying the differential equations describing the system. Experimental dynamic tests conducted on various types of heat exchangers support the validity of the theoretical transfer functions given. (P.C.H.)

6232 MASS AND HEAT TRANSFER IN THE FLOW OF FLUIDS THROUGH FIXED AND FLUIDIZED BEDS OF SPHERICAL PARTICLES. Ashis Sen Gupta and George Thodos (Northwestern Univ., Evanston, Ill.). A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 8: 608-10(Nov. 1962).

Experimental mass and heat transfer data for all types of beds reported in the literature were utilized to determine the exact dependences between the products ϵj_d and ϵj_h and the Reynolds number $D_p G/\mu$. For mass transfer the data of the investigations for gas and liquid films in packed fluidized, expanded, and distended beds were used. Values of mass and heat transfer factors calculated were compared with the corresponding values obtained from experimental data. (P.C.H.)

6233 TRANSIENT AND STEADY STATE, FREE AND NATURAL CONVECTION, NUMERICAL SOLUTIONS: PART I. THE ISOTHERMAL, VERTICAL PLATE. PART II. THE REGION INSIDE A HORIZONTAL CYLINDER. J. D. Hellums and S. W. Churchill (Univ. of Michigan, Ann Arbor). A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 8: 690-5 (Nov. 1962).

Numerical values are presented for the transient velocity field, temperature field, and local heat transfer coefficient. The results were obtained by solving the partial differential equations describing the conservation of mass, momentum, and energy on an IBM-704 computer with finite difference methods in time-dependent form. The computed values for short times agree very well with the analytical solution for conduction only, and the limiting values for long time agree well with previous solutions for the steady state. The existence of a temporal minimum in the heat transfer coefficient was confirmed. The time required for the heat transfer coefficient to approach its steady state is shown to be less than previously predicted. (auth)

6234 EQUATIONS FOR TRANSIENT HEAT TRANSFER IN PACKED BEDS. Adriaan Klinkenberg (Univ. of Texas, Austin). A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 8: 703-4(Nov. 1962).

A table is given of an array of terms from some frequently met infinite double-power series. Each term in the table was derived either from the one below it by an integration with respect to Y or from the one to the left by an integration with respect to Z. By combining groups of terms with equal degree, the sum is e^{Y+Z}. Some well-known relations in the field that can be easily proved by stepping left or down in the diagram are given. (P.C.H.)

6235 THE DYNAMICS OF THE EXPANDING VAPOR BUBBLE IN A BOILING LIQUID. P. Savic (National Research Council, Ottawa) and J. W. Gosnell. Can. J. Chem. Eng., 40: 238-45(Dec. 1962).

The theory of a constant pressure vapor bubble growing in a liquid with both superheat and subcooling is presented. In the case where the initial temperature profile is purely radial, bubble radius-time curves and temperature profile near the bubble are calculated. For the case of the hemispherical bubble growing on a plane heater surface with initially plane parallel temperature distribution, it is shown that the problem may be reduced to that of radial temperature profile if the inverse thickness of the superheated layer measured along the radius vector is averaged over the surface of the bubble. It is further shown that in the latter case vaporization is always present at the foot of the bubble, but condensation may occur near the top where the bubble penetrates furthest into the subcooled liquid. (auth)

6236 A PROFILOMETRIC TECHNIQUE FOR DETERMINING LOCAL MASS-TRANSFER RATES. APPLICATION TO THE ESTIMATION OF LOCAL HEAT-TRANSFER COEFFCIENTS IN A NUCLEAR REACTOR.

N. Macleod, M. D. Cox, and R. B. Todd (Univ. of Edinburgh and Heriot Watt Coll., [Edinburgh]). Chem. Eng. Sci., 17: 923-35(Nov. 1962).

A technique is described for determining local mass-transfer rates at a solid boundary by measurements of local changes in the thickness of a volatile (or soluble) surface coating. A probe comprising electromagnetic and pneumatic proximity gages allows the changes of coating thickness to be measured with an accuracy of $\pm 6 \times 10^{-5}$ in., and it is shown that this permits the accurate measurement of configurational changes small enough to have no significant influence on the motion of the fluid in many flow situations. The technique has been applied to the measurement of local rates of sublimation of naphthalene into an air stream from the surfaces of naphthalene-coated rods incorporated in a replica of the fuel-rod cluster of a gas-cooled nuclear reactor. A comparison of the results with local heat-transfer measurements indicates that the accuracy of the method is at present limited by the difficulty of preparing adherent coatings. (auth)

6237 THERMAL RESISTANCE OF THE JOINT BETWEEN A NUCLEAR FUEL AND ITS CANNING MATERIAL. J. A. Pearson. Nucl. Energy, 444-9(Dec. 1962).

Discussion is given on the correlation of experimental work on the thermal resistance of surfaces in contact with a theoretical model capable of giving reasonably accurate results over a wide range of conditions. In any projected fuel element the thermal resistance may be estimated to a fair degree of accuracy from the physical properties of the materials involved. However, it is concluded that more accurate information can only be obtained from experimental tests that also yield some information on compatibility. (P.C.H.)

6238 DISPERSION RELATIONS IN RAREFIED GAS DYNAMICS. Lawrence Sirovich (New York Univ., New York). Phys. Fluids, 6: 10-20(Jan. 1963).

The one-dimensional initial-value problem of a monatomic single component gas is considered. Using the linearized Boltzmann equation the dispersion relation is studied. In addition to the usual gas-dynamic sound waves, one finds an infinity of decaying propagating waves. The phenomenon exhibits itself as a sequence of epochs, the last state of which is hydrodynamic. With reference to the same problem, macroscopic equations such as Euler, Navier-Stokes, Burnett, moments equations, etc., are considered. In addition, the recently considered "kinetic models" of Gross et al., are applied to the problem. These various formulations are critically analyzed and compared with each other and with the Boltzmann analysis. Lastly, several modifications are offered which remedy some of the shortcomings which appear in the approximate theories. (auth)

6239 LAW OF THE WALL IN TURBULENT CHANNEL FLOW. C. L. Tien and D. T. Wasan (Univ. of California, Berkeley). Phys. Fluids, 6: 144-6(Jan. 1963).

In the fully developed turbulent channel flow, the linear and the logarithmic velocity distributions have been previously established for the wall region and the fully developed turbulent region in the constant stress layer. The transition from the linear to the logarithmic distributions, however, is not continuous. A theoretical expression for the mean-velocity distribution in the wall region is established that will give a continuous and smooth transition to the logarithmic distribution in the fully developed turbulent core. (L.T.W.)

6240 ABOUT FILM BOILING HEAT TRANSFER FROM A HORIZONTAL SURFACE. E. Ruckenstein (Polytechnical Inst., Bucharest). Rev. Phys., Acad. Rep. Populaire Roumaine, 7: 293-302(1962). (In English)

A non-stationary model of film boiling is used in which Taylor-Helmholtz instability and heat flux are considered as causes of bubble formation. Equations are derived for the heat flux and the minimum heat flux as a limiting case of film boiling. (D.L.C.)

6241 THE EFFECT OF TEST SECTION PARAMETERS ON SATURATION POOL BOILING BURNOUT AT ATMOSPHERIC PRESSURE. H. J. Ivey and D. J. Morris (Atomic Energy Research Establishment, Winfrith, Eng.). [Preprint No. W 5434] Paper No. 160. Chicago, American Institute of Chemical Engineers, 1962. 22p. (AEEW-R-176). $0.50.

Paper from 55th Annual Meeting, Chicago, Dec. 1962.

Experimental results are presented on the effect of test section parameters on saturation pool boiling burnout. The boiling condition chosen was a pool of water at atmospheric pressure and saturation temperature. The test section parameters considered were material, heater diameter, and heater wall thickness. A comparison with previously published data is made. (auth)

Materials Testing

Refer also to abstract 7543.

6242 (AWRE-O-34/62) AN IMPROVED CREEP TEST APPARATUS FOR USE WITH EXPLOSIVES. F. D. Harden and A. V. Woodbridge (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). May 1962. 30p.

An improved creep test apparatus is described in which pneumatic methods are employed to load the specimens and to produce automatically a continuous recording of creep. Although accuracy and reproducibility are the main criteria, the equipment enables the test to be carried out remotely and thus with greater safety when applied to explosives. (auth)

6243 (HW-74597) THE FEASIBILITY OF ULTRASONIC INSPECTION OF THICK WALL STEEL PIPE FOR WELD DEFECTS. G. L. Waldkoetter and C. L. Frederick (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 29, 1962. Contract AT(45-1)-1350. 6p.

Laboratory tests were performed to evaluate more refined techniques of weld defect detection. The use of "direct" reflection shear waves was found more promising than bounce or other techniques which are commonly applied. Artificial defects were used to evaluate the response to depth and orientation, and these defects consisted of both drill holes and etched slots. The results show that single transducer scanning is not adequate because the beam geometry does not provide coverage over the entire weld area. Some defect orientations give strong reflections when tested from one side of the weld, but no signal is observed when tested from the opposite side. Two methods were demonstrated which provide solutions to this problem: shuttle scanning and transducers on both sides of the weld. (auth)

6244 (HW-SA-2807) FISSION PRODUCT CASKS AND CONTAINERS PROTOTYPE DESIGN, SCALING OF MODELS FOR IMPACT TESTING. D. W. McLenegan (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Oct. 18, 1962]. Contract [AT(45-1)-1350]. 14p.

Various aspects of cask design are discussed that concern protection against impact forces. Provisions are described for normal heat dissipation and protection against excessive heat input from an external fire. Design criteria for model scaling for drop tests are detailed. (R.J.S.)

6245 (NP-12374) BIAXIAL BRITTLE FRACTURE TESTS. Research Report 62-107-543-R1. M. J. Manjoine (Westinghouse Electric Corp. Research Labs., Pittsburgh). Sept. 10, 1962. 21p.

The brittle fracture characteristics of a steel can be evaluated by a notched specimen if sufficient triaxial tension is developed at the notch. A biaxially loaded notched test specimen is described and the brittle fracture data generated with it are compared with those of two other types of test. Reliable data are obtained with the biaxially loaded specimen for a material of high brittle fracture resistance for which the other types of tests were not sufficiently discriminate. This new specimen can also be used in an irradiation program for determining the change in brittle fracture characteristics of stressed and unstressed materials. (auth)

6246 (NYO-10147) STRESSES AT NOZZLE CONNECTIONS OF PRESSURE VESSELS. PART I. DESCRIPTION OF NOZZLES AND TEST RESULTS. Period Covered: February 1, 1956–December 31, 1961. D. E. Hardenbergh and S. Y. Zamrik (Pennsylvania State Univ., University Park). Mar. 1, 1962. Contract AT(30-1)-1874. 80p.

The presence of a nozzle in a pressure vessel creates a region of increased localized stress in the vicinity of the opening. This study provides experimental data which show the general state of stress in nozzles. It was made on three types of outlets contained in cylindrical shells: (a) five hot-formed contoured nozzles, (b) four insert nozzles, and (c) one juncture reinforced by an annular pad. The nozzles differed in size, and in the amount and distribution of the reinforcing material around the outlets. Internal pressure and various external loads to the branch pipe were applied. (auth)

6247 (TID-17498) ON THE USE OF PLASTIC MODELS IN THERMAL STRESS STUDIES. Technical Report ME-3. C. W. Theisen, S. Thunborg, and R. Dove (New Mexico. Univ., Albuquerque. Engineering Experiment Station). July 1, 1962. (For Sandia Corp., Albuquerque, N. Mex.). Contract [AT(29-1)-789]. 259p. (SCDC-2936)

A moderately thick-walled plexiglas cylinder was instrumented on the outside surface along the longitudinal axis with thermocouples and strain gages. It was then temperature shocked at one end. This cylinder was a full scale model of an Al prototype which had been tested, and the wall thickness (h) to mean radius (a) was such as to place the tube in the middle of the (h/a) region. The original intention was to compare the results obtained from a study of this model to the results which were already available from a study of the Al prototype. This was not feasible, however, because the rise time of the temperature shock applied to the model simulated a rise time in the prototype which was much less than had ever been obtained in prototype testing. Therefore, the experimental results obtained in the study of the plastic model were compared to the results obtained from a computer solution of the theoretical expression. The agreement was good, and the validity of the model method for the study of transient thermal stresses is considered to be established. (auth)

6248 (EURAEC-393) OPERATIONAL METHODS FOR MAKING PRESSURE VESSELS. Quarterly Report No. 2, April 1–June 30, 1962. (Neratoom, N. V., The Hague). July 16, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 069-61-12RD N. 23p. A translation.

Test plates, 200-mm thick, were rolled and were examined by ultrasonic methods. The occurrence of slag occlusion and porosity in the preliminary experiments on arc welding under gas by means of CO_2 was thoroughly investigated. It was found that the slag occlusions had little effect on the static mechanical properties and that the cause of the porosity is probably due to the quality of the CO_2 gas which was used. The required apparatus is now being prepared for arc welding with CO_2 gas using a double head. For slag welding the heavier plates under CO_2 gas, it was found necessary to increase the gap between them. Further details were obtained on the intended destructive and nondestructive examination of welded seams. The destructive examination will include tensile tests, chemical analysis, and notch impact tests at various locations in the seam, as well as the determination of the transition temperature, the Cabelka test, and cross sections through the whole seam for the purpose of microscopic examination, hardness tests, and macrophotographs. The nondestructive examination will be concerned only with ultrasonic testing. (R.J.S.)

6249 RADIOGRAPHIC MACROSTRUCTURAL TESTING OF REINFORCED CONCRETE STRUCTURES. A. Hoenig (Brno Technical Inst.). Kerntechnik, 4: 499-503(Nov. 1962). (In German)

A general explanation is given of radiographic macrostructural testing of reinforced concrete structures, stereometric photographs, object contrast and photographic contrast, intensification foils, duration of exposure for radiographing reinforced concrete structures. (auth)

6250 IMPROVEMENTS IN OR RELATING TO ULTRASONIC TESTING OF MATERIALS. Raymond Ford Hanstock (to United Kingdom Atomic Energy Authority). British Patent 912,226. Dec. 5, 1962. Filed Dec. 21, 1959.

An apparatus is described for the ultrasonic testing of butt-welded steel plates of substantial thickness. An ultrasonic probe is adapted to transmit an ultrasonic input signal through the region of material to be examined. A number of probes are adapted to receive the output signals from this region. Means are provided for reproducing visually the relative strengths of the output signals. (R.J.S.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

Refer also to abstract 6538.

6251 (CDRP-182-109) TABULATION OF ESTIMATED MEANS, VARIANCES, CROSS AND AUTO COVARIANCES OF WINDS ALOFT FOR SOME SELECTED SEASONS AND LOCATIONS. Charles Bisson and R. R. Read (California. Univ., Berkeley. Inst. of Engineering Research). Oct. 30, 1962. Contract CD-SR-58-40. 50p.

A tabulation is presented by seasons of five years directional component means, variances, cross and auto-covariances of winds for 15 pressure levels and time lags up to three days at Oakland, summer and winter; Washington, summer and winter; Ft. Worth, summer and winter; Ely, autumn; Dodge City, winter; Hilo, spring. (auth)

6252 (CEA-2154) CONTRIBUTION A LA CONNAISSANCE GÉOCHIMIQUE DES FAMILLES DE L'URANIUM–RADIUM ET DU THORIUM DANS LES VOSGES MÉRIDIONALES. APPLICATION DE CERTAINS RÉSULTATS EN PROSPECTION DES GISEMENTS D'URANIUM. (Contribution to the Geochemical Knowledge of the Uranium–Radium and Thorium Families in the Southern Vosges. Applications of Some Results in the Prospecting of Uranium Deposits). Georges Jurain (France. Commissariat à l'Energie Atomique. Centre d'Études Nucléaires, Saclay). 1962. 349p.

Thesis submitted to Nancy. Université.

The geochemistry of the U–Ra and Th families in the Southern Vosges is applied to prospecting of uraniferous deposits. The following aspects are discussed: a concentration of U with secular disequilibrium in a thermal zone where satellite mineralizations form an epithermal paragenesis; a U–Ra disequilibrium in supergene minerals; a bond between Ca–Mg and U–Th in granites; and a relation between Rn in spring water and U–Ra of rocks. (R.J.S.)

6253 (CEX-59.4.16) AERORADIOACTIVITY SURVEY (ARMS-I) AND RELATED SURFACE GEOLOGY OF PARTS OF THE LOS ANGELES REGION, CALIFORNIA. Kenneth G. Books (Geological Survey, Washington, D. C. and Division of Biology and Medicine, AEC). May 1961. 25p. and chart.

A recent airborne gamma radiation survey in the Los Angeles region, California, shows a moderate range in the levels of natural radioactivity. The lower levels can be related to lowland alluvium, and the higher levels can be related to consolidated rocks. The highest radioactivity is associated with granitic intrusions and Tertiary volcanic rocks. The survey is nearly 2800 square miles in area. Continuous radioactivity profiles were obtained with scintillation counting equipment at approximately 500 ft above the ground on parallel north-south flight lines spaced 1 mile apart. A map of aeroradioactivity levels was prepared from the profiles. (auth)

6254 (CEX-62.6.1) ARMS-II—GALVESTON AREA AERORADIOACTIVITY SURVEY. R. B. Guillou (Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.). June 26, 1962. Contract AT(29-1)-1183. 41p.

An Aerial Radiological Measuring Survey (ARMS) of the Galveston area is reported. The survey was part of a nationwide program to measure present environmental levels of gamma radiation. Approximately 4400 traverse miles were flown, at an altitude of 500 ft above the ground, in the area that consists of the land portion of a 100-mile square centered on Galveston, Tex. The data are presented as aeroradioactivity units, or areas with similar gamma radiation rates at 500 ft, at two map scales. The aeroradioactivity in the area is less than 800 counts/sec, and in much of the area, the radioactivity is less than 400 counts/sec. Aerial measurements of ground radioactivity in the Galveston area were consistent everywhere with what was expected, considering the geology of the area. Most of the area has a low radioactivity, and the surficial materials are mostly Quaternary clays, silts, and sand, which are, in general, weakly radioactive. The western part of the area along the Brazos River is slightly more radioactive than the rest of the area. Artificial radionuclides are probably present in only small quantities because the maximum background gamma radioactivity in many places is less than 200 counts/sec. (auth)

6255 (HW-SA-2301) USE OF LAKE ROOSEVELT STORAGE TO LOWER RIVER TEMPERATURES. Harry A. Kramer and J. P. Corley (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 26, 1961. Contract [AT(45-1)-1350]. 22p.

It is shown that the effects of hot surface spill from dam reservoirs can be partially alleviated by planning and control of special water releases. Industries using river water for cooling realize benefits from this practice. (R.J.S.)

6256 (HW-SA-2854) SOLUTION METHODS FOR MULTIDIMENSIONAL PARTIALLY SATURATED FLOW IN SOILS. A. E. Reisenauer (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 12, 1962. Contract AT(45-1)-1350. 20p.

A computer program for solutions of multidimensional, partially-saturated flow problems is described briefly and experience in solving problems involving stability and convergence are discussed. A few examples of typical problems and their solutions illustrate the results obtainable from application of these computer techniques. The subsequent application of these methods, in combination with reliable micro-geological and soil-parameter characterization studies, is expected to contribute much useful information on waste movement and distribution patterns in the vadose zone beneath disposal sites. Extension of this work to solve other hydrologic problems also appears promising. (auth)

6257 (IS-438) THE ABSOLUTE ABUNDANCE OF THE CHROMIUM ISOTOPES IN SOME SECONDARY MINERALS. H. J. Svec, G. D. Flesch, and J. Capellen (Ames Lab., Ames, Iowa). [Mar. 14, 1962]. 8p.

Isotopic assays have been made on the Cr in samples from 14 different chrominiferous minerals from different geographic and meteoritic sources. The results of the assays indicate that it is not possible to state unequivocally that variations in isotopic composition have been observed. (auth)

6258 (NDL-TR-41) GAMMA DOSE RATE FROM NEUTRON-INDUCED ACTIVITY IN THE EARTH. Final Report. Samuel S. Holland, Jr., and Raymond Gold (Technical Operations, Inc., Burlington, Mass.). Oct. 15, 1962. Contract DA18-108-405-CML-1032. 99p. (TO-B-62-64)

Calculations of dose rate vs time due to neutron-induced radioactivity in the earth are presented. Calculations are performed under conditions of plane symmetry for neutron source energies of 14 Mev, 9.89 Mev, and 0.025 ev (thermal) for three different soil compositions and two water contents. Dose rate vs time curves is given for the

period of time between 2 min and 140 min after irradiation. (auth)

6259 (NP-12279) FISHER. Long Range Seismic Measurements [of] VELA-UNIFORM Project 8.4. (Air Force Technical Applications Center, Washington, D. C.). Dec. 3, 1961. 30p.

The FISHER shot was detonated on December 3, 1961, at the Nevada Test Site in alluvium at a depth of 1193 ft. An analysis of the film seismograms obtained at the LRSM (Long Range Seismic Measurements) Program sites is presented. Instrumentation at each of the stations consisted of 3-component short-period and long-period seismographs. Shots were recorded on 35 ml film and 1-in. 14 channel magnetic tape. Data are presented in tables and graphs. (M.C.G.)

6260 (NP-12280) SMALL BOY. Long Range Seismic Measurements [of] VELA-UNIFORM Project 8.4. DATDC Report No. 37. (United ElectroDynamics, Inc., Alexandria, Va.). July 14, 1962. Contract AF33(657)-7427. 20p.

The SMALL BOY shot was detonated July 14, 1962, at the Nevada Test Site in air 10 ft above the surface. An analysis of the film seismograms obtained in the long range seismic measurements program is presented. Instrumentation at each of the stations consisted of 3-component short-period and long-period seismographs. Data are given in graphs and tables. (M.C.G.)

6261 (NP-12281) SEDAN. Long Range Seismic Measurements [of] VELA-UNIFORM Project 8.4. DATDC Report No. 36. (United ElectroDynamics, Inc., Alexandria, Va.). July 6, 1962. Contract AF33(657)-7427. 20p.

The SEDAN shot was detonated on July 6, 1962, at the Nevada Test Site in alluvium at a depth of 660 ft. Short-period and long-period seismic data were recorded and analyzed. Data are presented in tables and graphs. (M.C.G.)

6262 (NP-12282) MERRIMAC. Long Range Seismic Measurements [of] VELA-UNIFORM Project 8.4. DATDC Report No. 38. (United ElectroDynamics, Inc., Alexandria, Va.). July 13, 1962. Contract AF33(657)-7427. 23p.

The MERRIMAC shot was detonated July 13, 1962, at the Nevada Test Site in alluvium at a depth of 1370 ft. Short-period and long-period seismic data were recorded and analyzed. Data are presented in graphs and tables. (M.C.G.)

6263 (NP-12283) AGOUTI. Long Range Seismic Measurements [of] VELA-UNIFORM Project 8.4. (Air Force Technical Applications Center, Washington, D. C.). Jan. 18, 1962. 34p.

The AGOUTI shot was detonated on January 18, 1962, at the Nevada Test Site in alluvium at a depth of 856 ft. Short-period and long-period seismic data were recorded and analyzed. Data are presented in tables and graphs. (M.C.G.)

6264 (NP-12284) ANTLER. Long Range Seismic Measurements [of] VELA-UNIFORM Project 8.4. (Air Force Technical Applications Center, Washington, D. C.). Sept. 15, 1961. 19p.

The ANTLER shot was detonated on September 15, 1961, at the Nevada Test Site in Tuff at a depth of 1318 ft. Short-period and long-period data were recorded and analyzed. Data are presented in tables and graphs. (M.C.G.)

6265 (NP-12297) PROCEEDINGS OF THE COLLOQUIUM ON DETECTION OF UNDERGROUND NUCLEAR EXPLOSIONS, HELD AT CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, CALIFORNIA, DECEMBER 14-15, 1961. VESIAC Special Report. Report No. 4410-36-X. (Michigan. Univ., Ann Arbor. Vela Seismic Information Analysis Center). Aug. 1962. Contract SD-78. 482p.

Presentations and discussions by representatives of government agencies, universities, and industries are included. The following basic subject areas are covered: numerical methods for the improvement of signal-to-noise ratio; mechanism at the focus and seismic wave propagation; depth of focus, epicenter location, and aftershocks; and seismograph development. (auth)

6266 (NP-12298) CHINCHILLA. Long Range Seismic Measurements [of] VELLA-UNIFORM Project 8.4. DATDC Report No. 23. (United ElectroDynamics, Inc., Alexandria, Va.). Feb. 19, 1962, Revised Nov. 7, 1962. Contract AF33(657)-7427. 27p.

The CHINCHILLA shot was detonated on February 19, 1962, at the Nevada Test Site in alluvium at a depth of 492 ft. Analyses of the seismograms recorded on short-period and long-period instruments are presented. Data are given in graphs and tables. (M.C.G.)

6267 (NP-12328) AARDVARK. Long Range Seismic Measurements [of] VELA UNIFORM Project 8.4. DATDC Report No. 23. (United ElectroDynamics, Inc., Alexandria, Va.). May 12, 1962. Revised Nov. 21, 1962. Contract AF33(657)-7427. 32p.

Information is presented concerning visual analysis of the AARDVARK seismograms. Practical solution of the problem of detection of underground nuclear explosions requires the accumulation of such information concerning amplitude, travel times, etc. (R.J.S.)

6268 (NP-12419) DANNY BOY. Long Range Seismic Measurements [of] VELA UNIFORM Project 8.4. DATDC Report No. 21. (United ElectroDynamics, Inc., Alexandria, Va.). Mar. 5, 1962. Contract AF33(657)-7427. 27p.

Danny Boy was detonated at the Nuclear Test Site on March 5, 1962, at 18:15:00.1 GCT. The coordinates for ground zero were Latitude 37°6'39.6" N. and Longitude 116°21'54" W. Usable seismic data for visual analysis were obtained to a distance of 900 km. This report is concerned solely with the visual analysis of the seismograms recorded at the various stations located throughout the United States. Although 36 stations were prepared to record this explosion, only 17 received a measurable signal that could be used for this preliminary analysis. The most distant station was Truth or Consequences, New Mexico, at a distance of 920 km southeast of NTS. Statistical data are compiled including travel times for P_n, P_g, and L_g wave fronts, the related earth motion in millimicrons/sec, residuals, etc. Digital analysis of these data and the comparison with other shots will be reported later. Sites receiving signals, coordinates, elevations, instrument bearings, and other general information are tabulated. Only short-period signals were received. An explanation of the procedure for amplitude measurements is illustrated. (R.J.S.)

6269 (NP-12420) HYRAX. Long Range Seismic Measurements [of] VELA UNIFORM Project 8.4. Geotech-TR-62-17. (Geotechnical Corp., Garland, Tex.). Sept. 14, 1962. 44p.

Seismic data recorded from the Hyrax event by the Long Range Seismic Measurements (LRSM) Program established under Vela-Uniform Project 8.4 are analyzed. Twenty-one of the 36 LRSM stations recorded one or more of the principal phases generated by Hyrax. Tables are included which summarize the measurements taken of the principal phases of this event. (R.J.S.)

6270 (NYO-10325) VARIATIONS IN ISOTOPIC ABUNDANCES OF STRONTIUM, CALCIUM, AND ARGON AND RELATED TOPICS. Tenth Annual Progress Report,

1962. (Massachusetts Inst. of Tech., Cambridge). Dec. 1, 1962. Contract AT(30-1)-1381. 141p.

A total of 29 individual studies are presented in their entirety. An additional 25 references are cited. (R.J.S.)

6271 (NYO-10464) HIGH ALTITUDE BALLOON SAMPLING PROGRAM. Quarterly Report No. 1. Colin G. Sanderson, Raymond J. Lagomarsino, Donald C. Bogen, and Philip W. Krey (Isotopes, Inc., Westwood, N. J.). Dec. 1, 1962. Contract AT(30-1)-3071. 51p.

Chemical and radiometric analytical procedures are described. The radionuclides included in these procedures are Be^{7}, Mn^{54}, $Sr^{89,90}$, Zr^{95}, Rh^{102}, Sb^{124}, Cs^{137}, Ba^{140}, and $Ce^{141,144}$. Also included is a discussion of the quality control schedule, radiometric calibration procedures for all nuclides included in the analytical procedures, and current research pertaining to the inclusion of Cd^{109} and Pu^{239} into the present procedure. The progress in the dissolution procedures of Del Bag filter paper, which has been used as a collection medium, is also discussed. (auth)

6272 (ORO-520) RADIOACTIVE FALLOUT. Annual Progress Report. P. K. Kuroda, L. M. Fry, H. L. Hodges, K. K. Meno, Tin Mo, J. Nix, and H. E. Moore (Arkansas. Univ., Fayetteville). Dec. 31, 1961. Contract AT(40-1)-2529. 168p.

Studies are reported on the following subjects: geochemistry of stratospheric fallout, variation of strontium-90 concentration within a single rainfall, stratospheric and tropospheric strontium-90 fallout after the French nuclear explosion, and the tropospheric residence time of strontium-90. (R.J.S.)

6273 (TID-17226) BIOENVIRONMENTAL FEATURES OF THE OGOTORUK CREEK AREA, CAPE THOMPSON, ALASKA. Including Predictions and Assessments of the Effects of Nuclear Detonations Proposed for an Excavation Experiment. A Second Summary Compiled by the Committee on Environmental Studies for Project Chariot. Bette Weichold, ed. (Atomic Energy Commission, Washington, D. C.). Oct. 1962. 194p.

A survey was made of weather and climate, geology, hydrology, soils, floristics and plant ecology, freshwater ecology, animal ecology, geologic patterns, biotic patterns, oceanographic characteristics, and the people of the Cape Thompson, Alaska area. Radiological analyses were made on marine materials, terrestrial materials, soils, air samples, and whole-body radioactivity of native humans. (C.H.)

6274 (TID-17467) DIRECT MEASUREMENT OF THE MERIDIONAL CIRCULATION IN THE STRATOSPHERE DURING THE IGY. Report No. 6. Abraham H. Oort (Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology). Oct. 15, 1962. Contract AT(30-1)-2241. 76p.

The mean meridional circulation in the stratosphere of the northern hemisphere is determined from IGY data available for a network of approximately 240 stations during the period July 1957–June 1958. Zonal averages for every 5° latitude from the equator to 80°N are presented. The yearly average suggests at 100 mb a three cell pattern with poleward motion north of 55°N, equatorial motion from 15° to 55°N, and weak poleward motion from the equator to 15°N. At higher levels equatorward motions are observed in middle and low latitudes. The highest meridional velocity of +60 cm/sec is observed at 70°N at the 100 mb level. These averages are compared with similar results for the southern hemisphere. Vertical velocities, computed adiabatically at 75 and 40 mb, made it possible to estimate the contribution of the diabatic heating to the horizontal meridional velocities at 50 mb, and also to give an estimate of the diabatic heating itself. (auth)

6275 (UCRL-6477) IN SITU MEASUREMENTS OF ELASTIC PROPERTIES. Durward D. Young, Jr. (California. Univ., Livermore. Lawrence Radiation Lab.). May 22, 1961. Contract W-7405-eng-48. 31p.

Calculated values for the in situ elastic constants of rigidity, bulk modulus, Young's modulus, and Poisson's ratio from in situ measurements of compressional and shear wave velocities were obtained at two shot complexes in volcanic layered tuff under varying overburden conditions. Compressional and shear particle motions were selectively generated at the bottom of 100-ft-deep shot holes drilled from the floor of a tunnel. Detectors were in the horizontal plane of the shot point at ranges between 35 and 374 ft. The measurements were obtained as a preoperational part of an experiment using a series of tamped, high-explosive shots at the Nevada Test Site in March 1960. The data were recorded photographically and by FM on magnetic tape. P and S travel times were obtained from the photographic records with a resolution of one-tenth millisecond. A computer program was written which received bottom hole coordinates, travel times of P and S, and densities. The output was Poisson's ratio, bulk modulus, rigidity modulus, and Young's modulus. Densities were obtained from cores taken from the exact location of the instruments. A comparison of Young's moduli computed from cores by various laboratory processes to the moduli computed from in situ velocity data shows lower but remarkably average values. (auth)

6276 (WT-502) AIR SHOCK PRESSURES AS AFFECTED BY HILLS AND DALES. M. L. Merritt (Sandia Corp., Albuquerque, N. Mex.). Sept. 15, 1952. Project 19.1e of OPERATION TUMBLER-SNAPPER. 29p.

Pressure measurements were made in order to gain more extensive quantitative information on the effect of hills upon shock waves from large-order explosions in air and to corroborate previous qualitative observations of the shielding effect of hills upon areas in their shadows. The data which were obtained pointed to a decided change in the shape of the shock wave with an increase in pressure as it progressed up the front slope, an intermediate transition phase of indeterminate nature as the shock wave passed over the top during which pressures were probably normal, a steady decrease in pressure as it moved down the lee slope, and a later recovery to normal pressures at the rear of the hill. (R.J.S.)

6277 HISTORY OF URANIUM EXPLORATION IN THE SOUTH ALLIGATOR AREA, N.T. J. R. Stewart (Australian Atomic Energy Commission, Lucas Heights, New South Wales). At. Energy, 5: No. 4, 23-32(Oct. 1962).

6278 SOME EFFECTS OF NUCLEAR EXPLOSIONS ON THE IONOSPHERE. G. G. Bowman (Univ. of Queensland, Brisbane). Australian J. Phys., 15: 405-19(Sept. 1962).

Examination of spread-F conditions at Brisbane and other stations adjacent to the Pacific area, together with an investigation of $h'F_2$ and f_0F_2 changes at the time, suggested that three disturbances propagated from the site of the nuclear explosion at Johnston I. on August 1, 1958. Somewhat similar variations of ionospheric parameters occurred after the explosion on the same site on August 12, 1958. The average speeds of these disturbances were 1666, 647, and 333 m/sec. It was suggested that the first was probably a hydromagnetic disturbance, and that pressure waves travelling in sound channels at 80 and 180 km respectively could be responsible for the other two disturb-

ances. Ionospheric conditions at Brisbane following Russian nuclear explosions in October 1961 tended to support the findings from the Johnston I. explosion. (auth)

6279 RADIOACTIVITY OF THE LAVA OF THE PUYS CHAIN. M. Goldsztein and S. Guillermo (Commissariat à l'Énergie Atomique, Paris). Bull. Soc. Franc. Mineral. Crist., 84: 6-8(Jan.-Mar. 1961). (In French)

The lava of the Puys chain forms a system with perfectly continuous magmatic differentiation. This permits the distribution of the radioactivity, of the total uranium, and of the soluble uranium to be followed in the rock series whose petrographic and geochemical position is defined with precision. Several correlation diagrams are presented. (tr-auth)

6280 UTILIZATION OF A 100-CHANNEL γ SPECTROMETER IN SOME PROBLEMS OF NUCLEAR GEOLOGY. R. Coulomb and M. Goldsztein (Commissariat à l'Énergie Atomique, Paris). Bull. Soc. Franc. Mineral. Crist., 84: 13-19(Jan.-Mar. 1961). (In French)

The Nuclear Geology and Geochemistry Group of the Mineralogy Service is making a systematic study of the distribution and migration of radioisotopes in various geochemical phenomena (granitization, volcanism, alteration, and lateritization). In addition to the classical techniques used (colorimetry, fluorimetry, and radiochemistry) and to very complete equipment for the detection of radiation, the Group has used for a year a spectrometer equipped with a 100-channel amplitude selector and magnetic memory. The apparatus and some determination methods adapted to the region of geochemistry are described. (tr-auth)

6281 STUDY OF THE RADIOACTIVITY OF THERMAL WATERS AND ROCKS OF THE REGION OF LAMALOU AND BEDARIEUX (HERAULT). M. Geslin and P. Urbain (Institut d'Hydrologie et de Climatologie, Paris). Bull. Soc. Franc. Mineral. Crist., 84: 194-8(Apr.-June 1961). (In French)

This region, situated at the eastern extremity of the Black Mountain, permits interesting comparisons between the radium and thorium concentration in formations deposited from the Antecambrian to the Quaternary (with numerous holes, naturally). On the other hand, the radioactivity of the thermal waters of Lamalou indicates that the geochemical extraction of radium from old rocks still continues, but that the extraction of thorium is almost complete. (tr-auth)

6282 ARTIFICIAL REPRODUCTION OF SOME MINERALS RICH IN ZIRCONIUM (ZIRCON, EUDIALYTE, CATAPLEITE, AND ELPIDITE); COMPARISON WITH THEIR NATURAL FORMATION CONDITIONS. M. Christophe-Michel-Lévy (Laboratoire de Minéralogie-Cristallographie, Paris). Bull. Soc. Franc. Mineral. Crist., 84: 265-9(July-Sept. 1961). (In French)

The artificial reproduction of eudialyte, of a purely sodium catapleite, of elpidite, and of four phases unknown in nature is described; they are not formed in the presence of alumina. A concentration of 5% Na_2CO_3 in water is indispensable to the formation of eudialyte; in less alkaline solution, zircon is crystallized. (tr-auth)

6283 A GEOMAGNETIC OBSERVATION OF A HIGH-ALTITUDE NUCLEAR DETONATION. B. Caner (Victoria Magnetic Observatory, British Columbia) and K. Whitman. Can. J. Phys., 40: 1846-51(Dec. 1962).

The magnetic record obtained about 5400 km (great circle) from Johnston Island, following a high-altitude (about 400 km) megaton nuclear explosion above this island at 09:00 UT on July 9, 1962, is described. The magnetic response consists of an increase larger than 18 γ in the geomagnetic field, followed by an oscillatory decay of this increase. Several hypotheses are presented to explain the high signal-propagation rate required by the data. (T.F.H.)

6284 PROSPECTING FOR URANIUM USING THE ANALYSIS OF RESIDUAL WATERS FROM OIL MILLING. Juan M. Martinez Moreno, E. Bermúdez Camacho, C. Gómez Herrera, and C. Janer del Valle (Instituto de la Grasa y sus Derivados, Seville). Energia Nucl. (Madrid), 6: 55-62(Apr.-June 1962). (In Spanish)

Olive trees grow on uraniferous soil fix uranium. In this work, the fixation of uranium by the olives and its distribution in the products of oil-milling operations are studied. The olives studied have uranium concentration up to 123 ppm. 63 to 92% of this uranium precipitates with the colloidal fraction separated from the vegetation water of the fruits when it is treated with alcohol. This permits uranium to be prospected in olives using the analysis of the residual waters of the olives. (tr-auth)

6285 SOME DATA ON THE RELATION BETWEEN THE DENSITY OF RADIOACTIVE FALLOUT AND THE DUST CONTENT OF ATMOSPHERIC AIR. Z. V. Dubrovina (Inst. of Radiation Hygiene, Leningrad). Gigiena i Sanit., No. 5, 97-100(May 1962). (In Russian)

The mean radioactive fallout in inhabited areas was 1.9 mC/km^2 during 10 months in 1959. The highest density was observed during April to June and the lowest in September. The monthly fallout for industrial regions was $+0.45 \pm 0.15$ and for park areas $+0.49 \pm 0.19$. Tabulated data are given on the ratio of radioactive fallout and the dust. It is postulated that the fine radioactive fallout particles are adsorbed by large-surface aerosols and the larger the amount and size of aerosol particles the higher is the radioactivity (due to diffusion and slower dispersion). (R.V.J.)

6286 NATURAL RADIOACTIVITY OF ATMOSPHERIC AIR AND ITS RELATION TO CERTAIN METEOROLOGICAL FACTORS. I. I. Gusarov (Sechenov Inst. of Medicine, Moscow). Gigiena i Sanit., 27: No. 6, 90-3(June 1962). (In Russian)

The relations between natural atmospheric radioactivity and temperature, atmospheric pressure, absolute and relative humidity, wind velocity, and dust were studied in air specimens taken in Moscow at 12 m from the earth's surface. The radioactivity was determined from radon daughter products. Tabulated data indicate that with slow horizontal air motion and high humidity the concentration of natural radioactivity is higher. (R.V.J.)

6287 DETECTION AND CONTINUOUS REGISTRATION OF THE CONTENT OF SHORT-LIVED RADIOACTIVE AEROSOLS IN THE AIR BY MEANS OF A FILTER "SATURATION" METHOD. S. P. Golenetskii. Gigiena i Sanit., 27: No. 7, 33-42(July 1962). (In Russian)

A description is given of a filter saturation method for continuously recording short-life radioactive aerosols. The maximum sensitivity of the method is up to 10^{-17} C/l for single determinations. For continuous automatic recording of samples with half lives from a fraction of a second to several minutes, the sensitivity is 10^{-15} C/l. The principle of the method is based on the compensation of decaying atoms by the newly collected atoms (saturation state). Thus the filter activity is proportional to the aerosol activity. With continuous sampling and short half lives the activity of the aerosols is directly proportional to the filter activity and in reverse proportion to the sampling rate. The construction of the filter for simultaneous recording of α- and β-active aerosols is shown. (R.V.J.)

6288 ON THE RADIOACTIVITY OF SOIL (2nd COMMUNICATION). V. N. Guskova and A. N. Bragina. Gigiena i Sanit., 27: No. 7, 103-5(July 1962). (In Russian)

An analysis of 193 samples taken from various regions in the Soviet Union in 1958 indicated a natural total soil β radioactivity of 0.166 up to 3.5 C/km^2. The K^{40} activity was from 3×10^{-9} to 1.8×10^{-8} C/kg; the radioactivity of the grassy cover was from 2×10^{-9} to 7×10^{-8} C/kg. The radioactivity of 50% of the samples was 1×10^{-8} to 3×10^{-8} C/kg with a mean of 1.4×10^{-8} C/kg. The radioactivity of plant roots was 1×10^{-8} to 3×10^{-8} C/kg, with a mean of 2×10^{-8} C/kg. In a 5-cm surface layer, the distribution of activity was 95.2 to 99.2% in the soil, with only a small percentage in the grassy cover and roots. (R.V.J.)

6289 ISOTOPIC COMPOSITION OF RUTHENIUM IN METEORITES. J. Feitknecht (Universität, Bern), W. Herr, and W. Hoffmeister. Helv. Phys. Acta, 35: 289-91(1962). (In German)

The isotopic compositions of Ru in the iron meteorites Tocopilla, Henbury, and Mount Joy were measured by mass spectroscopy. The isotopic ratios obtained were compared with terrestrial standards in an effort to detect any anomalies. Processes that could lead to special anomalies in the isotopic composition of Ru in meteorites are tabulated. The measurement results showed no anomalies. It was concluded that in Ru no special anomalies were to be expected when the meteorite does not originate, at least partially, by element synthetic processes other than those of the earth. (J.S.R.)

6290 ATMOSPHERIC RADIOACTIVITY DETERMINATION IN NUCLEAR REACTOR ENVIRONMENT ON THE BASE OF MEASUREMENTS OF TURBULENT DIFFUSION PARAMETERS. Milan Hašek. Jaderna Energie, 8: 382-8(Nov. 1962). (In Czech)

The influence of terrain and meteorologic conditions on the dissipation of radioactive exhausts from nuclear reactors, namely meteorologic-topographical measurements, Sutton's method (with modifications) of calculating maximum concentrations of substances contaminating the atmosphere as a result of turbulent effects is described. A new mathematic relation between temperature gradient and meteorologic exponent was found. On the basis of Scrase's presumptions some simplified measurements of macroviscosity were derived as well. Some values for terrain (field) measurements are reported. In accordance with simplified Lowry's formulas the measurement and calculation method for maximum concentration determination are described in detail. In conclusion, some new problems connected with atmospheric contamination in the environment of nuclear reactors are solved. (auth)

6291 RADIOGENIC STRONTIUM-87 MODEL OF CONTINENT FORMATION. P. M. Hurley, H. Hughes, G. Faure, H. W. Fairbairn, and W. H. Pinson (Massachusetts Inst. of Tech., Cambridge). J. Geophys. Res., 67: 5315-34(Dec. 1962).

Rubidium and strontium are used as tracers in the history of differentiation of the continental sial, and for this purpose it is assumed that the Rb/Sr ratio follows the aggregate enrichment of sialic components sufficiently well to represent an approximately linear measure of the entire process. Measurements of the Sr^{87}/Sr^{86} ratios in basalts and other igneous rocks of subsialic origin suggest that the source regions of sial have had a Sr^{87}/Sr^{86} ratio in the range 0.705 to 0.710 in different areas and at different times in the span of geologic history. Measurements of the Rb/Sr ratio in sialic rocks of the continental crystalline basement have indicated that the weighted average value for this ratio is in the vicinity of 0.25. This means that the Sr^{87}/Sr^{86} ratio in average sialic rocks of the continental basement would increase at a faster rate than that in the subsialic source regions, by an amount equal to approximately 0.010 per billion years. This is more than five times the standard deviation precision error in measurement. A comparison of the ratio Sr^{87}/Sr^{86} with the geologic age of the rock, in samples of typical sialic basement rocks leads to the conclusion that there has been a continuous generation of primary sial from subsialic source regions that has caused the continental areas to grow roughly in proportion to the extent of the geological age provinces. In North America this areal growth is estimated to be at the average rate of about 7000 km^2/m.y., and it seems to have been operative over most of geologic time. A model is formulated in which the proportion and age of reworked material that is incorporated into new sialic basement are related to the Sr^{87}/Sr^{86} development in the various materials involved. The model is generalized with all the parameters left open. An example set of values for the various parameters is tested on the model to indicate where there is need for more definitive data. This example set is derived from data available at present which, although very limited, indicate clearly that if the reworked material is young enough it can constitute a major proportion of a new sialic basement area, but if it is ancient (1 to 2 b.y. in primary age prior to incorporation) it could not be present in more than a minor proportion of the typical new basement. (auth)

6292 DEPOSITS OF URANIUM IN WESTERN EUROPE. W. Wimmenauer (Geogocisches Landesamt in Baden-Württemberg, Freiburg i. B.). Kerntechnik, 4: 583-5(Dec. 1962). (In German)

A brief review is presented of the different genetic types of uranium deposits: 1. Deposits of magmatic parentage (pegmatitic-pneumatolytic d.; hydrothermal d.); 2. Sedimentary deposits (uranium concentrations in the weathering zone; uranium mineralizations in sandstones; uranium-bearing bituminous shales; uranium-bearing placers). Most of the deposits recently mined in Western Europe belong to the hydrothermal vein type (Limousin, Vendée, Forez and Morvan in France; province Beira in Portugal; Menzenschwand in the Black Forest and others). France is the most important producer; its production exceeded 1000 T U-metal in 1961. Definite reserves are estimated up to 15000 T. Other deposits of economic interest have been found in Spain, Italy, Sweden and the Federal Republic of Germany. (auth)

6293 INVESTIGATIONS OF THE URANIUM, RADIUM AND RADIUM EMANATION CONTENTS OF NATURAL WATERS OF HIGH URANIUM CONTENT. Zoltán Dézsi. Magy. Tud. Akad. Atommag Kut. Int. (Debrecen) Kozlemen., 4: 93-6(Aug. 1962). (In Hungarian)

Investigations are carried out on the uranium, radium, and radon contents of natural water samples taken from the "Taktaköz" region. The uranium content is determined by the fluorometric method, and the radium and radon contents are determined by radiometric methods. The water samples under test show radioactive decay inequilibrium between the quantities of U, Ra, and Rn in the water. The Rn content far exceeds the Ra content. On the other hand, the U content in waters obtained near from the surface exceeds the radioactive equilibrium value corresponding to the particular Ra content in the water, whereas it falls behind the corresponding Ra content in waters obtained from deeper wells. (auth)

6294 THE THERMAL STATE OF THE EARTH. Christopher Crowe (Pennsylvania State Univ., University Park). Mineral Ind., Penn. State Univ., 31: 1-8(Feb. 1962).

The measurement of geothermal observables (temperature, thermal conductivity, heat flow, etc.) is discussed. A history of geothermal theories is given. Theories based on models of the earth are described. The results of these theories are outlined as regards internal temperatures, modes of solidification of the earth, and the thermal history of the earth at various depths. A bibliography of 58 references is included. (T.F.H.)

6295 NEW ZEALAND RADIOCARBON AGE MEASUREMENTS. [PART] 5. T. L. Grant-Taylor (New Zealand Geological Survey) and T. A. Rafter. New Zealand J. Geol. Geophys., 5: 331-59(May 1962).

A tabulated list of 117 samples dated by the radiocarbon method is given. Proportional counting of carbon dioxide gas was the method used, and the ages were calculated in terms of a half life of 5568 ± 30 yr. Samples from Antarctica and the deep ocean are excluded. The samples include 71 from New Zealand, 19 from Australia, 9 from Western Samoa, 4 from Subantarctic Islands, 4 from Borneo, 4 from Israel, 2 from West Africa, 2 from the West Indies, 1 from Saudi Arabia, and 1 from Peru. The samples are grouped in major categories as follows: Holocene Studies, Pleistocene Studies, Archaeology, Volcanology, and Miscellaneous. (auth)

6296 NUCLEAR EXPLOSIONS AT HIGH ALTITUDES (DISTURBANCES IN THE IONOSPHERE AND THE SPACE SURROUNDING THE EARTH). J. L. Alpert. Priroda, No. 8, 3-13(Aug. 1962). (In Russian)

A general picture is given of the physical phenomena taking place in the upper atmosphere (50 to 60 km) and in interplanetary regions near the earth. Disturbances in radiowave propagation, optical effects, artificial aurora, magnetic perturbations, low-frequency signals, and artificial radiation belt are discussed. (R.V.J.)

6297 THE CONWAY GRANITE OF NEW HAMPSHIRE AS A MAJOR LOW-GRADE THORIUM RESOURCE. J. A. S. Adams, M.-C. Kline, K. A. Richardson, and J. J. W. Rogers (Rice Univ., Houston, Tex.). Proc. Natl. Acad. Sci. U. S., 48: 1898-1905(Nov. 15, 1962).

The results of studies on Conway granite in New Hampshire indicate that tens of millions of tons of thorium are available when the need for vast amounts of higher-cost nuclear fuel becomes pressing. The amounts may be compared to the few hundreds of thousands of tons of previously estimated thorium reserves. Methods for the determination of thorium in Conway granite are also discussed. (P.C.H.)

6298 YALE NATURAL RADIOCARBON MEASUREMENTS. [PART] VI. Minze Stuiver and Edward S. Deevey (Yale Univ., New Haven, Conn.). Radiocarbon, 3: 126-40 (1961).

Most of the measurements made since publication of Yale V are included; some measurements, such as a series collected in Greenland, are withheld pending additional information or field work that will make better interpretations possible. In addition to radiocarbon dates of geologic and/or archaeologic interest, recent assays are given of C^{14} in lake waters and other lacustrine materials, now normalized for C^{13} content. The newly accepted convention is followed in expressing normalized C^{14} values as $\Delta = \delta C^{14} - (2\delta C^{13} + 50)[1 + (\delta C^{14}/1000)]$ where Δ is the per mil deviation of the C^{14} if the sample from any contemporary standard (whether organic or a carbonate) after correction of sample and/or standard for real age, for the Suess effect, for normal isotopic fractionation, and for deviations of C^{14} content of the age- and pollution-corrected 19th-century wood standard from that of 95% of the NBS oxalic acid standard; δC^{14} is the measured deviation from 95% of the NBS standard, and δC^{13} is the deviation from the NBS limestone standard, both in per mil. These assays are variously affected by artificial C^{14} resulting from nuclear tests. (auth)

6299 YALE NATURAL RADIOCARBON MEASUREMENTS. [PART] VII. Minze Stuiver and Edward S. Deevey (Yale Univ., New Haven, Conn.). Radiocarbon, 4: 250-62 (1962).

Many of the measurements made since publication of Yale VI are included, but many are withheld pending receipt of more complete information or additional samples. Dates are reported in terms of the Libby half life of C^{14}, 5570 ± 30 yr; geochemical measurements, when normalized for C^{13} content, are given as Δ in parts per mil, as described in Yale VI. (auth)

6300 THE EARTH AND COSMOLOGY. R. H. Dicke. Science, 138: 653-64(Nov. 9, 1962).

The detection of a slow decrease in the gravitation constant (G), by analyzing changes in the earth's size, internal and external temperature, magnetic field, and continental configuration, is discussed. Cosmologies having a slowly decreasing G are outlined. (T.F.H.)

6301 SCANDIUM, ITS GEOCHEMISTRY AND MINERALOGY. L. F. Borisenko. Authorized Translation From the Russian. New York, Consultants Bureau Enterprises, Inc., 1961. 81p. $17.50.

The history and physicochemical properties of Sc are discussed briefly. The occurrence of Sc in nature and Sc minerals are discussed. The genetic types of Sc-bearing deposits are considered, and the main features of Sc geochemistry are discussed in detail. (D.L.C.)

HEALTH AND SAFETY

Refer also to abstracts 5749 and 5750.

6302 (AD-276119) SURVEYS OF FALLOUT SHELTER—A COMPARISON BETWEEN AERIAL PHOTOGRAPHIC AND DOCUMENTARY METHODS. D. C. Kleinecke (California. Univ., Berkeley. Inst. of Engineering Research). Feb. 1, 1960. 37p.

In 1959 a large part of Contra Costa County, California, was surveyed for fallout shelter areas. This survey was based on an examination of the tax assessor's records of existing buildings. A portion of this area was also surveyed independently by a method based on aerial photography. A statistical comparison of the results of these two surveys indicates that the aerial photographic method was more efficient than the documentary method in locating potential shelter space in buildings of heavy construction. This result, however, is probably not operationally significant. There is reason to believe that a combination of these two survey methods could be devised which would be operationally preferable to either method. (auth)

6303 (AD-276121) A SIMPLE METHOD OF DETERMINING THE FALL VELOCITY OF FALL-OUT PARTICLES. A. Broido, G. M. Corcos, and A. McMasters (California. Univ., Berkeley. Inst. of Engineering Research). July 14, 1961. Contract CD-SR-58-40. 19p.

A vertical wind tunnel was built for the purpose of fractionating irregularly shaped fallout particles according to their fall rates. If, before fractionation, the fallout material is mixed with a quantity of spherical glass beads of appropriate diameter (100 to 300 microns), the effective size of the irregularly shaped particles can be determined by measuring the diameter of the glass beads which are ejected in the same fraction. The fall velocity of the particles can be computed directly by computing the fall velocity of the glass beads. A complicated ejection rate curve was observed for each size of glass bead. Relatively clean separations and accurate fall velocity determinations are possible, even with the present apparatus, by fractionating spherical particles of two different densities and comparing the fall velocities as determined with each material. (auth)

6304 (ARF-3187-10) ELECTROSTATIC CLASSIFICATION OF SUBMICRON AIRBORNE PARTICLES. Progress Report, October 1 to December 1, 1962. G. Langer (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Contract AT(11-1)-578. 5p.

Progress is reported on the development of a routine charger that has no aerosol losses. Efforts were directed toward elimination of electric wind effects by flow system modification. The problem of air dilution introduced by the air sheath was not entirely overcome. (R.J.S.)

6305 (BNL-6501) SOME SPECIFIC CONSIDERATIONS OF THE POTENTIAL HAZARDS OF HEAVY PRIMARY COSMIC RAYS. Howard J. Curtis (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 22p.

The ionization produced by the heavy cosmic ray particles is almost entirely highly concentrated along single tracks, and the microscopic dose in tissue within these tracks may be quite high but the overall dose rate from these particles in outer space would be very low. These particles cannot be produced in the laboratory so a microbeam of deuterons has been developed which simulates the ionization pattern of these particles. Using this microbeam on mice it is found that this type of radiation causes very little effect in either the brain or the eye, and presumably also in other vital organs. However, it will cause greying of the hair. It is concluded that this type of radiation will not cause a serious hazard for space flight. (auth)

6306 (CDRP-182-105) A DISCUSSION OF THE FEASIBILITY OF ESTIMATING FALLOUT BY REGRESSION METHODS. D. C. Kleinecke and R. R. Read (California. Univ., Berkeley. Inst. of Engineering Research). Sept. 25, 1962. Contract CD-SR-58-40. 42p.

Statistical multiple regression techniques have been applied to the problems of estimating the deposition coordinates of fall-out particles and the radiation intensity levels from the fallout. A stochastic model of the winds aloft is used to reflect the effect of variability due to the passage of time. Wind hodograph information and radiation measurements at ground level serve as regression variables. The error of estimation of deposition coordinates has been quantified and the estimates have been compared with those based on an assumption of persistent winds. The computational problems of attempting to quantify the error of estimating radiation levels are quite difficult and have not been adequately solved. These problems are discussed and some qualified subjective estimates are made concerning the magnitude of these errors. (auth)

6307 (CDRP-182-112) A COMPARISON BETWEEN ANDERSON'S "DYNAMIC" MODEL OF FALLOUT AND OTHER MODELS. D. C. Kleinecke (California. Univ., Berkeley. Inst. of Engineering Research). Oct. 30, 1962. Contract CD-SR-58-40. 16p.

A. D. Anderson has presented a dynamic model of fallout in which particles are traced from zero time to time of deposit, with the implication that it has little correspondence to the usual models based on a stabilized cloud. It is shown that a close analog to a stable cloud occurs in the dynamic model when it is used for large detonations, sufficient to justify the operational conclusion that the dynamic model can be replaced by an equivalent stable cloud model. The dynamic model is, however, potentially useful as a model for stem formation and studies of wind distortion of the stable cloud. (auth)

6308 (CRER-1098) MAXIMUM PERMISSIBLE CONCENTRATIONS OF RADIOACTIVE NUCLIDES IN AIRBORNE EFFLUENTS FROM NUCLEAR REACTORS. P. J. Barry (Atomic Energy of Canada Ltd., Chalk River, Ont.). Oct. 1962. 45p. (AECL-1624).

The maximum permissible concentrations in air of various biologically significant radionuclides have been calculated for members of the public who live in the neighborhood of a nuclear power reactor. They have been calculated both for continuous exposure during routine reactor operation and also for emergencies resulting from reactor accidents. The recommendations are not intended to be used as normal health physics control levels but to serve as a guide to reactor designers. The problems of atmospheric diffusion are discussed and values for maximum permissible discharges or discharge rates are recommended so that the maximum permissible concentrations in air should not be exceeded. (auth)

6309 (DPSPU 62-30-5) CONTROL OF TRITIUM HEALTH HAZARDS AT THE SAVANNAH RIVER PLANT. W. C. Reinig (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.) and E. L. Albenesius (Du Pont

de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Jan. 1962. Contract AT(07-2)-1. 16p.

The essential components of the program for the control of tritium hazards at Savannah River include radiological engineering, training of operating personnel in techniques of protection, protective clothing, control of surface and air contamination, bioassay, and environmental monitoring. Rapid change of air in process areas and the continuous measurement of tritium in air are two important facets of the protection program. Workers in a tritium atmosphere wear inexpensive, polyvinyl suits which are supplied with air and envelop the entire body. Permissible working time limits are established with the help of a nomograph that reflects the tritium concentration in air and the protective value of air masks or plastic suits. Employees submit urine specimens after jobs involving tritium exposure. These specimens are immediately assayed by means of liquid scintillation counting. Grease, oil, and other hydrocarbons retain tritium. Surface contamination is detected qualitatively by use of smears and gas flow proportional counters. Ventilation air from process areas is released to the environs through tall stacks. The stack air is continuously monitored. At the perimeter of the plant and 25 miles away, air is sampled to determine the effect of tritium released through the stacks. The Savannah River, streams on the plant, and food produced in the vicinity of the reservation are routinely analyzed. The tritium levels in the environs of the Savannah River Plant are substantially less than the limits recommended by the International Commission of Radiological Protection for large populations. (auth)

6310 (HW-SA-2411) THE REMOVAL OF RADIOISOTOPES FROM THE COLUMBIA RIVER BY NATURAL PROCESSES. Julian M. Nielsen and Richard W. Perkins (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 10, 1962. Contract AT(45-1)-1350. 13p.

Some radioisotopes are introduced into the Columbia River by return of the water used to cool the Hanford reactors. Trace amounts of both fission product and activation product radioisotopes are present and measurable by sensitive radiochemical methods to allow determination of the self-purification processes occurring as the water moves downstream. By comparing the radioisotope input at given times with the amounts present in the river after traveling downstream, a measure of the self-purification rate was obtained. Removal in the first 40 miles downstream from the reactors was about 35% for 15 of the most prominent radioisotopes. The removal rate seemed to decrease with subsequent distance traveled downstream for three radioisotopes for which measurements were made. Radiochemical analyses of water, filterable solids, and sediment samples taken at downstream locations indicate that incorporation in sediments accounts for most of the removal. Because of the intense scouring action of the Columbia River, sediments are deposited in significant amounts only in slack water sections. The first extensive slack water section downstream from Hanford is the McNary Dam reservoir, Lake Wallula. Radiochemical analyses of some of the long-lived radioisotopes, including Mn^{54}, Co^{60}, Zn^{65}, and Cs^{137} on sectioned sediment core samples indicate a widely varying rate of deposition of radioisotopes. Dating of the various sections of the cores was accomplished using isotope ratio measurements. (auth)

6311 (HW-SA-2843) FISSION-PRODUCT CONFINEMENT PROGRAM AT HANFORD AND SUPPORTING RESEARCH STUDIES. R. K. Hilliard, C. E. Linderoth, and E. R. Irish (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 3, 1962. Contract AT(45-1)-1350. 29p.

Small laboratory-scale tests were performed to obtain knowledge of the quantity and nature of fission product release from overheated reactor fuel elements, to obtain knowledge of the deposition of such fission products, and to provide facilities to confine released fission products. Applications to reactor fuel incidents both in and out of reactors are briefly described. (R.J.S.)

6312 (NP-12238) NUCLEAR PORT SURVEY OF THE STATE OF NEW YORK. (Ebasco Services, Inc., New York). Nov. 1961. 170p.

A survey was made of port facilities of New York State to determine their capability to construct and service atomic propelled vessels and to handle the shipment of packaged radioactive materials, including used nuclear fuels. Information pertinent to the development of nuclear industry in New York State is presented. (C.H.)

6313 (NP-12349) DESIGN FOR A CAST-IN-PLACE CONCRETE SHELTER. Final Report. J. R. Allgood, R. M. Webb, and R. F. Swalley (Naval Civil Engineering Lab., Port Hueneme, Calif.). Dec. 13, 1962. 105p. (R-191)

An economical, arch-shaped shelter, utilizing pneumatically-placed motar, has been developed as an alternate to existing standard types. Criteria and plans for a 100-man shotcrete shelter are presented which will provide protection against an overpressure of 100 psi and concomitant effects from nuclear weapons. Shotcrete is recommended because of the economic advantages gained from using a single lightweight form as opposed to the heavy double form required for conventionally placed concrete. An effort has been made to provide a balanced and versatile design which may be adapted to various specific needs. Methods for the design of the basic structural components of the shelter are given, including a method for estimating the relative displacement between the floor and the foundation when the structure is subjected to blast loading. Simple yet adequate design procedures are given which are suitable for use in the design office. (auth)

6314 (NP-12386) THE ANALYSIS, OPTIMIZATION, AND DESIGN OF AN AIRBORNE RADIATION SAMPLING ELECTROSTATIC PRECIPITATOR (thesis). Robert Stanley Stuart (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio). May 1962. 105p. (GNE/Phys/62-16)

The analysis, optimization, and design of a two-stage parallel plate precipitator are discussed. An IBM 7090 digital computer program is used to achieve all theoretical results. Negative corona discharge is used throughout, and aerosol charging by bombardment and diffusion methods are combined into one time dependent equation. Precipitator optimization theory is presented and the effects on precipitator sensitivity and efficiency of varying corona current, velocity, and geometry are studied in detail. A theoretical design is presented in order to determine the feasibility of precipitation at high velocities and altitudes. (auth)

6315 (ORNL-1559) PHYSICAL DOSIMETRY IN TYPICAL BIOLOGICAL EXPERIMENTS WITH FAST NEUTRONS FROM A CYCLOTRON SOURCE. C. W. Sheppard and E. B. Darden (Oak Ridge National Lab., Tenn.). Aug. 27, 1953. Contract W-7405-eng-26. 11p.

Results obtained in operation and control of a fast-neutron facility which receives radiation from the 86-in. cyclotron are discussed. The cyclotron facility is described, and discussions concerning fast-neutron dosimetry and methods for controlling biological exposures are included. (J.R.D.)

6316 (ORNL-3284) APPLIED HEALTH PHYSICS ANNUAL REPORT FOR 1961. (Oak Ridge National Lab., Tenn.). Dec. 17, 1962. Contract W-7405-eng-26. 61p.

The environmental contamination levels observed prior to the arrival of weapons fall-out in September, 1961, were slightly lower than the levels recorded during 1960. After September, 1961, the average contamination level remained several times higher than the level observed during the weapons testing moratorium, 1958 to 1961. The average air concentration level for the Laboratory during 1961 was 0.16% of the $(MPCU)_a$. Two significant personnel exposures were recorded during the year. One employee received a relatively high soft radiation exposure to his left hand. A second employee received a similar exposure to the right hand. During 1961, there were no cases of internal deposition of radioactive materials estimated to average greater than one-third of a permissible amount in the body. As of December 31, 1961, and as the result of an accident which occurred in 1957, only one individual had accumulated a total dose which exceeded the age proration formula, 5(N-18). During 1961, the Laboratory experienced approximately 75 unusual occurrences of which only two were classified as major. These two incidents resulted in hand exposures as noted above. (auth)

6317 (OTO-58-3) TASK GROUP 7.5 RADIOLOGICAL SAFETY SUPPORT. OPERATION HARDTACK, PHASE I. Carl Minkkinen, comp. and ed. (Holmes and Narver, Inc., Los Angeles); Henry P. Schlacks, Roscoe H. Goeke, and Charles L. Weaver, comps. and eds. (Albuquerque Operations Office, AEC). Apr. 1959. 41p.

The task force organization and its equipment and supplies are detailed. The programs of fallout monitoring and decontamination are described, and data collected are presented. A fallout protection study is briefly reviewed. (R.J.S.)

6318 (PLASTEC-NOTE-5) HEALTH HAZARDS AND TOXICITY OF PLASTICS: A CROSS-INDEXED BIBLIOGRAPHY. Arnold E. Molzon (Picatinny Arsenal. Plastics Technical Evaluation Center, Dover, N. J.). Mar. 1962. 23p.

A total of 73 selected references pertaining to the toxicity and/or health hazards present during the fabrication of plastics and their normal use is listed. These items are cross-indexed according to type or class of plastic material, subject, and author. Indexes are provided for materials, subjects, and authors. (R.J.S.)

6319 (TID-15445) RADIOLOGICAL SAFETY IN THE LABORATORY. Russell F. Cowing (New England Deaconess Hospital. Cancer Research Inst., Boston). [Apr. 16, 1962]. Contract AT(30-1)-901. 14p.

The use of ionizing radiations by the veterinarian for diagnostic procedures can be carried out without any hazard to the veterinarian or his assistant, provided that proper techniques are employed. Some of the accepted methods of protection against x-rays and the handling of radioactive isotopes are discussed. (auth)

6320 (TID-16553) PERSONAL RADIATION EXPOSURES IN FACILITIES LICENSED TO USE RADIOISOTOPES IN 1960. Final Report. Donald E. Barber and G. Hoyt Whipple (National Sanitation Foundation, Ann Arbor, Mich.). Oct. 31, 1962. Contract AT(11-1)-1012. 89p.

An attempt was made to estimate the typical radiation doses received during 1960 by persons employed by AEC licensees who used radioisotopes in various ways. Personal radiation exposure data were collected from the exposure records of 3,864 persons employed by 253 licensees. The analysis of these data together with personal communications with licensees shows that average whole-body, external radiation doses received from radiation sources used in eight different ways are well below the radiation protection guides recommended by the Federal Radiation Council. Further, average radiation exposures in the eight use categories studied did not exceed the minimum detectable doses of personal monitors. The interpretation of the data depends heavily upon the limitations of personal monitoring devices. These limitations and their effect upon the results of the study are discussed. The observations lead to the principal conclusion that the everyday risks of life are far greater than those associated with radiation exposure in the eight use categories studied. (auth)

6321 (TRG-Report-342) THE EXTINGUISHING OF PLUTONIUM FIRES. J. Holliday and W. A. Conway (United Kingdom Atomic Energy Authority. Reactor Group, Dounreay, Caithness, Scotland). June 15, 1962. 13p.

A fusible ternary eutectic salt mixture of barium, sodium, and potassium chlorides was developed as an extinguishant for metallic fissile material fires. The powder extinguished fires involving massive and finely divided uranium and massive plutonium, but was not successful with fires involving finely divided plutonium, combustion continuing under the powder. Tests indicated that a fusible ternary eutectic of sodium, potassium, and lithium fluorides would act as a more efficient extinguishant and would be capable of extinguishing fires involving finely divided plutonium. The mixture was used successfully on fires involving plutonium, both in the massive and finely divided states. (auth)

6322 (UCLA-499) ENVIRONMENTAL PATHWAYS OF RADIOACTIVE IODINE FROM NUCLEAR TESTS IN ARID REGIONS. Norman R. French and Kermit H. Larson (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). Dec. 1961. Contract AT(04-1)-Gen-12. 18p.

Radioiodine produced in the fission process is released to the environment in weapons tests, in reactor accidents, and in the processing of fuel elements. It is distributed as a gas or incorporated in small particles. In either case it is deposited on the surface of the desert vegetation. It is then available for ingestion by desert animals. Some may be deposited on the soil surface. Investigation of these sources of radioiodine ingested by Kangaroo rats indicates that the contaminated food supply accounts for most of the material taken in by the animals, but that contaminated soil also provides important quantities. The soil is both accidentally ingested and taken in by licking the fur. (auth)

6323 (UCRL-9967) NEUTRON DOSIMETRY IN AND AROUND HUMAN PHANTOMS BY USE OF NUCLEAR TRACK EMULSION. Hiroaki Akagi and Richard L. Lehman (California. Univ., Berkeley. Lawrence Radiation Lab.). Nov. 30, 1961. Contract W-7405-eng-48. 41p.

The power of nuclear track research emulsion as a fast neutron dosimeter is examined in the exposure of a human phantom to PuBe neutrons. Semiautomatic track scanning and high-speed data analysis obviate the major disadvantages of this dosimeter, and allow the following basic information to be obtained without a serious cost in time: the relative proton recoil energy spectrum, the absolute differential proton track density spectrum, and the average proton recoil energy at various locations in the phantom. From this are calculated the total absorbed local tissue dose due in proton recoils, the local thermal neutron intensity, and that portion of the tissue dose resulting from thermal N(n,p)C tracks. (auth)

6324 (USNRDL-TR-582) DESIGN MODIFICATIONS AND 1962 COST ANALYSIS FOR A STANDARDIZED SERIES OF FALLOUT SHELTERS. Lewis G. Porteous (Naval Radiological Defense Lab., San Francisco). Sept. 17, 1962. 130p.

Major emphasis is on recent design modifications and 1962 cost estimates for the personnel fallout shelters described in USNRDL-TR-366, Specifications and Costs of a Standardized Series of Fallout Shelters (1959). The shelter is designed to accommodate at least 100 persons for 14 days. It is believed that the shelter will provide the specified fallout and blast protection, the required interior environment, and the essential hotel-type equipment at minimum cost. The shelter items are specified by several packages, each having one or more different arrangements of items, depending on the degrees of protection and comfort desired. The proper selection of packages will result either in a 35-psi or 10-psi blast and fallout shelter sited above or below grade. The radiation protection factor is at least 1000. Most austere to least austere living accommodations can be selected. Average cost data for the packages by item are tabulated for quantities up to 1000. Respective costs for four complete shelters, combinations of most austere and least austere with 35-psi and 10-psi, have been estimated and are presented graphically. Costs for shelter quantities were estimated by means of learning curves. The costs range from $19,800 for the least-austere 35-psi shelter to $14,200 for the most-austere 10-psi shelter. The design modifications are based on findings of the USNRDL Shelter Research Program for the period, 1959 to June 1962. Drawings are included. (auth)

6325 (JPRS-16072) PROBLEMS OF SURGICAL TREATMENT FOR INJURIES CAUSED BY RADIATION. A. Morczek and K. Neumeister. Translated from Deut. Gesundheitsw., 17: 1266-70(July 1962). 10p.

The treatment of persons injured in radiation accidents is discussed. It is pointed out that the mechanisms of injury from a nuclear weapons explosion are fundamentally the same as in nuclear reactor accidents. Dangers from external irradiation and from the absorption of radioactive materials are reviewed, with emphasis on radioactive contamination of wounds and their surgical treatment. (C.H.)

6326 (UCRL-Trans-838(L)) RAY-PROTECTION FOR FIREMEN EXPERIENCES FROM THE UNITED STATES OF AMERICA. Farrenkopf. Translated by Sergey Shewchuck (Univ. of California. Lawrence Radiation Lab., Livermore) from VFDB (Ver. Forder. Deut. Brandschutzes) Z., 11: 1-4(1962). 11p.

Results of a survey concerning the essential features of radiation protection in American fire departments are presented. Included are sections on precautionary protection and preparations, radiation protection training, equipment and instruments, operating procedures, use of special task groups, demonstrations, reactor station fire protection, and catastrophe plans. (J.R.D.)

6327 DIRECT MEASUREMENT OF INHALED DOSES FOLLOWING REACTOR ACCIDENTS. W. M. Pusch (Philips G.m.b.H., Vienna). Atompraxis, 8: 423-30(Nov. 1962). (In German)

The various possibilities of estimating the internal radiation stress which results from breathing contaminated air following a reactor accident are discussed: (1) an estimate of the internal dose based on the MPC value of the most toxic isotope present; (2) an estimate of the internal dose based on a simplified formula which presupposes that the concentration of the individual isotopes remains constant, or that the concentration is measured repeatedly; (3) an estimate of the thyroid dose caused by I^{131}, using a measuring system combined with a dust collector, which permits direct reading of the values necessary for the calculation. (auth)

6328 THE EUROPEAN CONVENTION ON THE CIVIL LIABILITIES IN THE REGION OF ATOMIC ENERGY. Otto K. Kaufmann. Atomwirtschaft, 7: 395-402(Aug.-Sept. 1962). (In German)

The principal features of the OEEC agreement on civil liability in the case of nuclear incidents are summarized. (J.S.R.)

6329 REMARKS ON THE SECURITY PRECAUTION REGULATIONS. Erich Hoeft. Atomwirtschaft, 7: 456-9 (Aug.-Sept. 1962). (In German)

The German regulations on the provision of financial responsibility in nuclear energy liability are briefly summarized, paragraph by paragraph. (J.S.R.)

6330 ASSESSMENT OF RADIATION HAZARDS. W. M. Court Brown. Brit. Med. J., 2: 368(Aug. 5, 1961).

The minimum dose of radiation necessary to injure cells, induce tumors, and to shorten life is discussed. It is suggested that a given dose of radiation carries a risk of leukemia but that the risk is greater in old than young subjects. This was supported by chromosome counts. It was found that the number of hypomodal cells (with fewer chromosomes) and the number of hypermodal cells (with more chromosomes) increased with age. The number of these non-modal cells also increased after irradiation, particularly after whole-body irradiation or exposure of large areas. The relative number of abnormalities increased with the dose. The example is cited of 80 chromosomes in one leukocyte after irradiation of a patient for carcinoma of the testis. (H.H.D.)

6331 MAXIMUM PERMISSIBLE CONTAMINATION OF RESPIRABLE AIR AFTER AN ACCIDENTAL RELEASE OF RADIOIODINE, RADIOSTRONTIUM, AND CESIUM-137. Report to the Medical Research Council by its Committee on Protection Against Ionizing Radiations. Brit. Med. J., 2: 576-9(Aug. 26, 1961).

It was considered that the values previously recommended for the maximum permissible dose or dose-rate to critical organs after the absorption of these radioisotopes from the diet should also be applicable for their inhalation during an emergency. Thus the maximum intakes of radioiodine proposed for various ages correspond to a total thyroid irradiation of 25 rad; the intakes for Sr^{89} and Sr^{90} correspond to a total of 15 rad and an annual rate of 1.5 rad/yr respectively, at sites of highest concentration in bone; and the Cs^{137} intake given a total dose of 10 rad to the whole body. For the total lung dose, the proposed value is 15 rad. The recommended intakes, either separately or collectively, will not result in an average dose to the lung as high as the maximum level of 15 rad referred to above, except in the unlikely event of an intake of Cs^{137} in the form of insoluble particulate material. The values are lower for children than adults. A table is provided showing the maximum permissible intakes and time integrals of concentrations in air for each isotope and for various age groups. (H.H.D.)

6332 STATISTICAL ASPECTS OF THE PROGRAM OF THE ATOMIC BOMB CASUALTY COMMISSION. Gilbert W. Beebe (Atomic Bomb Casualty Commission, Hiroshima and Nagasaki). Bull. Inst. Intern. Statist., 38: 203-15(1961).

The Atomic Bomb Casualty Commission is a medical research institute in Hiroshima and Nagasaki devoted to long-

term study of the late effects of nuclear radiation upon man. The inferences to be drawn are largely statistical inferences growing out of the comparison of samples defined as to radiation exposure with samples from non-exposed populations. Procedures used for data collection and processing are described. Factors influencing the program and its conduct are discussed with emphasis on statistical aspects. (C.H.)

6333 STATISTICAL ASPECTS OF TUMOR REGISTRIES IN HIROSHIMA AND NAGASAKI. Morihiro Ishida (Dept. of Epidemiology, ABCC and Branch Lab., Japanese NIH). Bull. Inst. Intern. Statist., 38: 223-34(1961).

All cases of cancer in Hiroshima and Nagasaki are registered for evaluation of the methods of treatment, to study etiologic and pathologic aspects of cancer, and to gather statistics relating to medical care and cancer control. The accuracy of diagnosis of cancers and the cause of death of cancer patients are discussed. Results are reported from a statistical analysis of tumor incidence in Hiroshima and Nagasaki and the differential incidence of tumors relating to exposure of the populations to radiation from atomic explosions. (C.H.)

6334 RADIOACTIVE FACTORS IN WATER POLLUTION. J. E. Guthrie (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem. Eng., 40: 273-6(Dec. 1962).

The introduction of radionuclides into bodies of water as a result of nuclear reactor operations is discussed. The off-site water monitoring program at the Chalk River Plant of Atomic Energy of Canada is outlined. Factors affecting the disposal and measurement of radionuclides in water are considered. (P.C.H.)

6335 NOTES ON THE REPORT OF THE BRITISH COMMITTEE ON RADIOLOGICAL HAZARDS TO PATIENTS (1960). F. D. Sowby (Dept. of National Health and Welfare, Ottawa). Can. Med. Assoc. J., 86: 532-4(Mar. 24, 1962).

The findings of this committee (Adrian Committee), obtained from surveys of British hospital practices, were compared with data from Canadian hospitals. The volume of diagnostic radiology in Canadian hospitals does not appear to differ much from that in British hospitals, and the frequency distribution of diagnostic examinations is similar. The main contributors to the genetic dose are those examinations performed in large hospitals rather than in private practice and small hospitals. Thus, as a first approximation, it is thought that the genetic dose from diagnostic radiology in Canadian hospitals might be similar to that in the National Health Service Hospitals in Britain. Additional contributions from private practice in Canada are not likely to alter this grossly. The genetic dose from the use of unsealed radionuclides is about the same in Canada as in Britain, the Canadian value being slightly higher. The main difference between the 2 countries lies in the contribution from I^{131}, and this may be due to more conservative practice in Britain. The British report estimates that 12.7 c of I^{131} were administered in a 3-month period, or 50.8 c per year; this corresponds to 1.04 c per million population. In 1956, 31.3 c of I^{131} were shipped to medical users in Canada; in a population of 16.1 million this corresponds to 1.94 c per million population. Thus, without allowing for wastage of Canadian shipments, it appears that Canadian consumption of I^{131} was 1.9 times that in Britain. The annual genetic dose from this source in Canada was 2.8 times that in Britain. (H.H.D.)

6336 RADIOACTIVE MATERIALS IN FOOD CHAINS. R. Scott Russell. Chem. Ind. (London), 1227-8(July 7, 1962).

Surveys conducted in Britain on the levels of radioactivity in diet are discussed. In no case have the levels specified by the Medical Research Council been approached and it is assumed that the Sr^{90} which will be deposited in the present year (1962) will not change the situation. In the short period since weapons tests were resumed in 1961, the thyroid glands of very young children, who were fed largely on fresh milk, may have received radiation doses in excess of those received from natural background in 1 year. A wide safety margin, however, remained. (H.H.D.)

6337 RADIOACTIVITY OF WATER. E. Windle Taylor. Chem. Ind. (London), 1229(July 7, 1962).

The significance of radioactivity, both natural and man-made, is discussed in relation to drinking water supplies in Britain. Regular examination of the major surface drinking water supplies of Great Britain and Northern Ireland revealed that water contributes only a very small proportion of human daily ingestion of Sr^{90}. Monitoring for total beta activity was carried out by many water works and although this gave no indication of the individual radionuclides present, it gave prompt information of the general level of activity and whether or not pollution occurs from discharge of radioactive substances into a water course. The data obtained indicate that man's activities have had no significant effect on the general level of radioactivity of Great Britain's drinking water supplies. (H.H.D.)

6338 PROTECTION OF THE PUBLIC FROM THE HARMFUL EFFECTS OF MAN-MADE RADIONUCLIDES IN FOOD UNDER CONDITIONS OF WAR AND PEACE. G. A. Wortley. Chem. Ind. (London), 1230(July 7, 1962).

Possible peacetime risks to food from nuclear weapon test fallout and discharge of radionuclides from atomic energy establishments during normal operations and in the event of accidents are outlined. Generally, milk is the agricultural food at greatest risk, firstly, from radioiodine and later from Sr^{90} and Cs^{137}. The vulnerability of seafoods depends on local conditions and habits, calling for special surveys to protect the individual. If the contamination due to accident were to exceed the accepted maximum permissible levels then alternative safe supplies would be arranged. Under wartime conditions an increased risk from fallout in food, both as grown and in storage, would occur. Some reduction of the hazard during processing is possible, such as with flour, sugar, and probably fats. The possibility of removing Sr^{90} from milk by an ion-exchange resin appears promising, and the salvage of meat from heavily irradiated farm animals would call for preservation by improvised as well as conventional means. (H.H.D.)

6339 CIVIL DEFENSE IN THE FOOD INDUSTRY. I. THE CAPABILITIES OF CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL (CBR) WARFARE AGENTS. Furniss L. Parnell (Office of Civil and Defense Mobilization, Washington, D. C.). Food Technol., 16: No. 1, 15-17(Jan. 1962).

The possible effects of CBR agents on food supplies are discussed, with particular respect to the challenge such agents pose to the food industry. Cooperation of the food industry can ensure success of the government's 2-week supply food-stockpiling program for emergency survival. The emergency survival food products needed should be developed to meet these requirements: Ready to eat; requiring no cooking, although liquid may need to be added, and heat applied for palatability. Easy to store; compact in size, requiring no refrigeration, resistant to moisture, pests, and temperature variations, and having reasonably long shelf life. Easy to serve; calories per serving easily measured, together with minimum waste after meals. Nutritionally balanced; including complete dietary needs with

appropriate ratio of proteins, carbohydrates, fats, vitamins, and minerals. Palatable; marketable to the public now for current use to establish acceptability, thus avoiding the hazard of strange food in an emergency. Economical; cheap enough to encourage people to buy for current use as well as emergency survival purposes. Such steps that food scientists and technologists may take to encourage stockpiling of foods in both homes and shelters will assist the total Civil Defense program. (H.H.D.)

6340 CIVIL DEFENSE IN THE FOOD INDUSTRY. 3. RADIOLOGICAL HAZARDS IN PROCESSED FOODS RESULTING FROM NUCLEAR WARFARE. H. F. Kraybill (National Cancer Inst., Bethesda, Md.). Food Technol., 16: No. 2, 13-6(Feb. 1962).

The level of radioactive contamination in foods contributed by natural sources, fallout radionuclides from nuclear-weapons testing, and the calculated high levels from a nuclear attack are discussed to show the relative influence of these factors on the safety of the food supply. Packaged or processed foods stored in a shelter might withstand damage from the blast effect of a nuclear detonation. However, processed food subjected to blast and thermal damage might be slightly radioactive from neutron activation, as demonstrated in the 20-KT shot in the 1955 Nevada tests. Allowing for radioactive decay, such foods would be safe to consume in a few weeks. Unharvested food crops, heavily contaminated with fallout from nuclear detonations in a war, would require careful decontamination under competent supervision. These foods also provide the starting materials for processed and canned foods, so remedial measures (washing, milling, or refining, and special processing) would be required. Processed foods in cans or glass would be preferred following nuclear attack. The safety of consumption and the wholesomeness of radionuclide-contaminated foods is discussed and it is concluded that they could be used under some conditions during the dire emergency of an immediate post-war period. (H.H.D.)

6341 HYGIENIC ISSUES ON THE STUDY OF THE EFFECT OF AUGMENTED NATURAL RADIOACTIVITY BACKGROUND OF ENVIRONMENT ON THE POPULATION'S HEALTH. Yu. V. Novikov and I. I. Rezanov. Gigiena i Sanit., 27: No. 3, 76-84(May 1962). (In Russian)

The effects of high natural radioactivity in open waters and air on the population are analyzed, and data are tabulated indicating the concentration of radioactivity in various regions. Data on the amount of radium in the water and in the human body and the death rate from malignant bone growth are correlated. (R.V.J.)

6342 ON RADIATION SAFETY IN SEARCH AND PROSPECTING OF USEFUL MINERALS. P. I. Maiseytsev (Ministry of Health, USSR). Gigiena i Sanit., No. 5, 68-72 (May 1962). (In Russian)

Rules and regulations are given for personnel radiation protection during geological exploration and prospecting using radioisotopes. (R.V.J.)

6343 DECONTAMINATION TESTS OF VARIOUS METAL SURFACES AND OF SOME TYPES OF COATING SYSTEMS. Otakar Bartl and Zdeněk Dlouhý. Jaderna Energie, 8: 389-93(Nov. 1962). (In Czech)

The sorption of radioactivity by selected materials and the deactivation efficiency of some solutions were tested. A fission product mixture was used as the contaminant. In the choice of materials their applicability in nuclear power plant design was considered. (auth)

6344 SHIELDING REQUIREMENTS FOR DENTAL INSTALLATIONS. Albert G. Richards (Univ. of Michigan School of Dentistry, Ann Arbor). J. Am. Dental Assoc., 64: 788-93(June 1962).

Shielding requirements for dentist's offices in which diagnostic x-ray procedures are used are outlined with reference to the National Bureau of Standards Handbook 76. Tables are provided showing protective radiation barriers necessary for more realistic workloads than those provided by the Handbook. The data include necessary barrier thickness for various building materials (and their lead equivalents) for workloads of 500 ma-sec/week at 70 and 100 kvp. When lead shielding in the walls is necessary it is available in the following forms: lead glass, lead insulated concrete partition blocks, lead insulated gypsum partition blocks, lead-clad plywood, lead-backed rocklath, and lead-backed sheet rock. A list of the names of the suppliers of these materials is provided. However, many walls, constructed of conventional building materials, offer more than adequate shielding of persons from undue exposure to x radiation. (H.H.D.)

6345 ESTIMATES OF THE KILL PROBABILITY IN TARGET AREA FAMILY SHELTERS. Philip W. Russell and Laddie G. Kimbrel (Wichita Clinic, Kan.). J. Am. Med. Assoc., 180: 25-9(Apr. 7, 1962).

Single-shot kill probabilities for persons with specified degrees of protection within a target area were calculated as a guide in the choice of family emergency planning and, specifically, to compare the safety of underground shelters versus basement fallout shelters. Probabilities were estimated by relating the calculated lethal radii for various weapon yields and the distance from the target point to a current ICBM aiming error. Curves were constructed showing kill probability at varying distances from the target point for selected megaton yields with specified degrees of protection. For example, a comparison showed that a person 4 miles from a 5-megaton ICBM target point would have a 97% risk of being killed within a basement fallout shelter, or an 8% risk within the specified underground shelter. The Office of Civil Defense family fallout shelter constructed in basements with 8-in., unreinforced concrete blocks was selected for analysis because its design has been so widely distributed. Certain fatality would occur in this shelter at a peak over-pressure of 10 psi, and it would collapse at approximately 3 psi. The underground shelter selected for analysis was one which would withstand 30 psi peak overpressure, and would have radiation shielding equivalent to 12 in. of concrete plus 30 in. of earth. (H.H.D.)

6346 GAMMA SPECTROMETRIC STUDIES ON FALLOUT AND ITS CONTENT OF RADIONUCLIDES. E. Schmid, F. Grass, and F. Hecht (Analytischen Institut der Universität, Vienna). Mikrochim. Acta, 884-90(Nov. 8, 1961). (In German)

Radionuclides were sought in rainwater samples collected in Vienna on January 1, 1961 and May 12, 1961. Analysis of the 1st sample 33 days after collection showed the presence of 3 short-lived radioisotopes: Ba^{140}, La^{140}, and I^{131}, with half lives of 13 days, 40 hr, and 8 days, respectively. These presumably originated as fission products from the French nuclear weapons test in the Sahara Desert 5 days previously, on December 27, 1960. In contrast, no radionuclides could be detected by this method on May 12, 1961 although a similar weapons test was conducted at the end of April 1961. It is suggested that the fission yield may have been lower in this 2nd weapons test. (H.H.D.)

6347 THERMONUCLEAR WAR. George Mixter, Jr. (New York Medical Coll.). New England J. Med., 267: 570-1(Sept. 13, 1962).

Several criticisms are offered of statements made in the series of articles on thermonuclear war. The statement that human bodies would be particularly hazardous missiles seems erroneous in that their maximum translational velocity 15 miles from ground zero would not be over 24 ft/sec. Glass fragments at this 15-mile radius could attain, however, a velocity of 170 ft/sec, which puts them in the highly dangerous classification. The statement was made that persons subjected to overpressures of 20 to 50 psi are more likely to be killed by secondary or tertiary effects. Twenty psi overpressure from a 20-megaton weapon would be generated at a radius of 4.8 miles from ground zero, and would arrive in ~14 sec. During the period before 14 sec., 60% of the total thermal pulse would have been delivered. At this radius the thermal dose from the entire pulse would be ~700 cal/cm^2; since only 10 cal is sufficient to produce a severe second-degree burn, and since some 420 cal/cm^2 would have been incident upon any human beings in direct line of sight from the weapon before the onset of blast, it hardly seems necessary to consider secondary or tertiary effects. A further statement that flying glass and masonry would travel at the speed of sound is unacceptable, since the order of magnitude of translational speeds of glass fragments is known to be far less than Mach 1. A statement that the major thermal pulse of this type of weapon is an infrared pulse, containing nearly 35% of the bomb's energy is incorrect in that the majority of the thermal output is in the visible range. The statement that an air burst would produce little or no local fallout is also incorrect if one assumes weapons of megaton size, since the fireball radius is so large that the earth's surface would become involved in it. (H.H.D.)

6348 EXPOSURE DOSE OF PATIENTS IN DIAGNOSTIC RADIOLOGY. H. Hirozumi, Y. Naito, H. Matsuura, and A. Izeki (Nagoya Univ., Japan). Nippon Hoshasen Gijutsu Gakkai Zasshi, 16: Nos. 3-4, 150-69(1961).

Factors bearing on the exposure dose such as the type of x-ray unit, filter, cone, and intensifying screens, are discussed and the results of actual measurement of exposure doses of patients examined in 37 hospitals in Nagoya are described. (Abstr. Japan Med., 2: No. 9, Sept. 1962.)

6349 THE RESPONSIBILITY OF THE DENTAL PROFESSION IN REDUCING EXPOSURE TO IONIZING RADIATION. Arthur H. Wuehrmann (Univ. of Alabama, Birmingham). Oral Surg., Oral Med., Oral Pathol., 14: 304-10 (Mar. 1961).

Four areas of responsibility in the field are cited: to recognize that radiologic health responsibilities actually exist; to provide educational opportunities for the members of the profession in areas of radiologic health pertinent to dentistry; to be certain that dentists avail themselves of such educational opportunities and use this new knowledge in routine office work; and to defend dentistry's right as a member of the health science team to make its own decisions as to when and how much ionizing radiation should be used. While American dentistry contributes minor amounts of gonadal radiation per person, it does add, through the use of its 95,000 x-ray machines, to the gonadal radiation of the population as a whole. It is estimated that 1 mr of gonadal radiation is produced for each r of facial exposure. Thus a total of 50 r is produced per complete mouth x ray, with a maximum gonadal dose of 50 mr. This dose could presumably be reduced by a factor of 4 if the fastest films were used. The daily gonadal dose being distributed by dentists to the total American population is between 76 and 6000 r (20 × 0.04 mr per film of gonadal radiation × 95,000 = 76 r; 20 × 3.16 mr per film of gonadal radiation × 95,000 = 6000 r). On the basis of a population of 180 million and an estimated 3.5 r of background radiation in a 32-year period to the average person in the population, the total background radiation delivered per day to the entire population is ~57,500 r. On a percentage basis, therefore, dentistry appears to add to the population's total daily gonadal dose from 0.1 to 10% of that being received daily through background radiation. It is probably reasonable to estimate that dentistry is presently adding about 7% to the average person's background dose. This figure is likely to decrease as more dentists utilize radiation-reducing methods. (H.H.D.)

6350 STATEMENT ON THE HAZARDS OF RADIOACTIVE FALLOUT. Lee E. Farr. Pediatrics, 29: 845-7 (May 1962).

In a meeting on January 22 and 23, 1962 the Committee on Environmental Hazards considered the problems posed for pediatricians by fallout by radioactive materials on the United States. It reviewed data on the duration, amounts, and hazards of radioactive I^{131} and Sr^{90} in fallout, data and reports of new processes for removal of Sr^{90} from milk, as well as reports on long-term studies of Japanese survivors of Hiroshima and Nagasaki and people of the Marshall Islands who were exposed to fallout from nuclear weapons testing. It concluded that the present Sr^{90} content of milk is less than that which is capable of inducing recognizable deleterious effects in infant, child, or adult during average lifetimes. Laboratory methods for the removal of Sr^{90} from milk are now being tested, and if it becomes necessary, these can probably be developed through pilot stages to commercially applicable procedures. About 80% of Sr^{90} ingested will be immediately excreted so that the body burden increases more slowly than does the environmental contamination. The cow thus eliminates 80% of environmental Sr from its milk. The present level of I^{131} in foods, liquids, and atmosphere is also well below the levels at which alerting of the population is required by governmental standards, which are very conservative. Blocking doses of stable I are not at this time necessary. Prophylactic administration of carrier I as a blocking agent presents the probability of developing iodism in large numbers of children by well-intentioned but uniformed practitioners. Should I^{131} or Sr^{90} in the environmental significantly increase, those agencies charged with protection of the population will inform these groups responsible for the development of appropriate recommendations and procedures. (H.H.D.)

6351 GONADAL EXPOSURE DOSE IN X-RAY EXAMINATION OF THE HIP JOINT OF INFANTS. H. Yoshinaga, A. Tabuchi, and S. Nakagawa (Hiroshima Univ.). Proc. Inst. Nucl. Paediat. Res. (Japan), 1: 15(1960).

In x-ray screen photography of the hip joint of infants, the average dose received by the gonads was inferred to be about 160 mr in boys and 100 mr in girls. The gonadal dose was estimated to be 50 mr in boys and 25 mr in girls in normal radiography of the hip joint. However, when the gonads were protected from x rays, the gonadal dose was reduced to about $\frac{1}{10}$ in boys, and $\frac{1}{5}$ in girls. The results were supported by phantom measurements. (Abstr. Japan Med., 2: No. 9, Sept. 1962.)

6352 GONADAL EXPOSURE IN THE INFANT BY CHEST PHOTO-RADIOGRAPHY. S. Yoshinaga and S. Nakagawa (Hiroshima Univ.). Proc. Inst. Nucl. Paediat. Res. (Japan), 1: 29(1960).

The ovaries of 10% of girls below school age were irradiated by direct x rays when chest films were obtained

by routine method. Boys below school age were not exposed to direct x rays over their gonads. In school girls about 0.6% received direct x rays over the gonads during the same examination. The ovarian dose was assumed to be about 10 mr per exposure. The chief reason for this is a radiation field of too large a size when the film is being taken. When x raying an infant, the gonads should be completely shielded from x rays as a routine procedure. (Abstr. Japan Med., 2: No. 9, Sept. 1962.)

6353 MATHEMATICAL MODEL OF TRANSPORT MECHANISMS INFLUENCING STRONTIUM 90 LEVELS IN MILK. Robert H. Shumway (Public Health Service). Public Health Rept. (U.S.), 77: 1055-64(Dec. 1962).

A mathematical model was developed for the purpose of predicting Sr^{90} concentrations in milk. The level of Sr^{90} in milk reflects the concentrations of Sr^{90} in pasture and barn feed. Based on these assumptions, the model includes the following factors: deposition rate, rate of absorption from the soil, the residence time of Sr^{90} on the plant, and the proportion of cows on pasture feed and of cows on barn feeding. The derived equation allows values for specific areas to be considered for a particular time period. The model is fitted to approximately 5 years of observed milk measurements from 5 metropolitan areas comprising the original raw milk sampling network. Deviations of the observed values from those given by the model were interpreted as fluctuations arising from experimental error or secondary perturbations or both. Calculated values were generally found to be reasonable. (P.C.H.)

6354 RADIOIODINE IN THYROID GLANDS OF PORTUGUESE SHEEP DEPOSITED BY THE SAHARA EXPLOSION. F. Barreira (Centro de Estudos de Fisica da Comissão de Estudos da Energia Nuclear, Lisbon) and J. Amaral Mendes. Rev. Cien. Vet., 56: 174-81(July–Sept. 1961). (In Portuguese)

The activity of sheep thyroids in Portugal was determined after the North Africa nuclear tests. We collected glands of animals from different districts. Our survey started at tne end of February and finished in June. The measurements show an activity increase to a maximum about the middle of April, falling with a global half-life of 9 days. The highest value of the thyroid activity was 800 μμc/g. (auth)

6355 ATMOSPHERIC RADIOACTIVITY IN LISBON AFTER THE EXPERIENCES ON THE SAHARA. F. Barreira (Laboratoire de Physique de la Comissão de Estudos de Energia Nuclear, Lisbon). Rev. Fac. Cien., Univ. Lisboa, 2a Ser. B, 7: 143-54(1960). (In French)

Gummed paper was used to collect samples of particulate matter from the air for analysis for radioactivity. Data are presented on the activity in samples collected at Lisbon during February and March, 1960. The increase in activity was attributed to the Sahara atomic explosions. (C.H.)

6356 RADIOIODINE IN MILK OF COWS CONSUMING STORED FEED AND OF COWS ON PASTURE. B. Kahn (Robert A. Taft Sanitary Engineering Center, Cincinnati), C. P. Straub, and I. R. Jones. Science, 138: 1334-5 (Dec. 21, 1962).

During a period of 17 days, 2 months after termination of the Russian nuclear test series in 1961, I^{131} was measured in milk. Within 2 days the herd on pasture showed 270 pC I^{131} per liter of milk. This concentration decreased with a half-life of 7 ± 1 days. No I^{131} was found in the milk from sheltered cows that consumed stored feed. (auth)

6357 THE DOSE DISTRIBUTION BY THE HORIZONTAL MOTION OF THE TELECOBALT APPARATUS. Werner Bohndorf and Dietrich Harder (Universitäts-Hautklinik, Würzburg, Ger.). Strahlentherapie, 119: 389-400(Nov. 1962). (In German)

The effect of horizontal motion of the irradiation table was investigated for obtaining an enlargement of the irradiation field of an average telecobalt unit. Dose distributions were investigated systematically. The best homogeneity was obtained when there was a small ratio of the field length used to the length of the totally covered motion field. The required irradiation time was increased. Because of the geometrical conditions an increased homogeneity of the surface dose was obtained in case of motion. This reduced the surface dose in the center of the field by about 15 to 20% in contrast to a comparable fixed field irradiation. The practical use is demonstrated by an example. (auth)

6358 UNIFORM IRRADIATION OF THE FOCUS BY SUITABLE LAYER DEPTH OF THE ROTATING PENDULUM AXIS FOR MOVING FIELD IRRADIATION. Hans Ludwig Keller (Universitätsklinik Erlangen-Nurnberg, Ger.). Strahlentherapie, 119: 401-4(Nov. 1962). (In German)

Almost uniform irradiation in the area of the focus must be obtained during moving field irradiation. Using an example it is shown, that an optimal homogeneity of the focus irradiation cannot be obtained by having the pendulum axis in the focus center or the dose maximum in the tumor center. The greatest uniformity of the focus irradiation will be obtained, if the front side and the back side of the focus get equal dosages. The way to obtain this aim is shown by example. (auth)

6359 THE BURDEN TO THE SURFACE IN ROTATIONAL IRRADIATION WITH RADIATION OF 100 kev TO 100 Mev. Felix Wachsmann and Iwao Azuma (Universität Erlangen-Nurnberg, Ger.). Strahlentherapie, 119: 405-18 (Nov. 1962). (In German)

The problem of the influence of radiation energy on the relative depth dose obtained by using rotational irradiation was investigated for radiations of 100 kev (normal radiation) to 17-Mev-x-ray radiation using uniform conditions. The diameters of the phantoms used varied between 12 and 30 cm and the field sizes between 3 and 7 cm. Because of the properties of high energy radiation, that is, greater relative depth dose, built-up effect, and less scattering, decreasing skin burdening results from increasing radiation energy related to the same focal doses. The requirement of keeping the skin dose three times smaller than the focal dose can be already accomplished with the conventional radiation for small fields in case of rotational irradiation. In case of larger fields, harder radiation, for example Co^{60} gamma rays or even better ultrahard radiation, is necessary. The use of radiation energies higher than about 10 to 20 Mev is not necessary and in certain cases even unprofitable. (auth)

6360 DOSE CAPACITY MEASUREMENTS IN THE ENVIRONMENT OF RADIO-IODINE-THERAPY PATIENTS. Rolf-Wilhelm Fiehmig and Friedrich Motzkus (Freien Universität, Berlin). Strahlentherapie, 119: 467-73(Nov. 1962). (In German)

In the first law of June 24, 1960, § 22.2, about protection against damage caused by radiation from radioactive substances a radiation dose of 150 mrem/year was determined as the maximum permissible dose for persons outside of the control area. According to this value, a dose rate of 0.54 mr/h at 1 m distance is satisfactory for dismissal of patients, who have received radioiodine for therapeutic purposes, from the control area of the hospital. This value can be determined with sufficient accuracy with the usual rate meters. This could be proven by comparing measure-

ments of different rate meters from several companies. The presumptive stay in the hospital of patients receiving radioiodine therapy can be estimated and included in the therapy plan, using graphs. (auth)

6361 SOME PROBLEMS OF ORGANIZATION OF WORK AND OF RADIATION SAFETY IN X-RAY ROOMS. V. P. Vikturina and V. I. Gordon (State Inst. of Scientific Research In Roentgen-Radiology, USSR). Vestn. Rentgenol. i Radiol., 37: No. 5, 49-54(Sept.-Oct. 1962). (In Russian)

Sanitary and safety rules for medical personnel handling radioactive materials are described, and regulations and specifications are given for construction and operation of x-ray rooms. Permissible exposures and doses are quoted, and the problems of occupational hazards are discussed. (R.V.J.)

6362 APPLICATION OF EXTERNAL ENERGY ABSORBERS TO LARGE FISSION PRODUCT SHIPPING CASKS. D. W. McLenegan, C. W. Smith (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.); E. A. Ripperger, and J. E. Breen (Texas. Univ., Austin. Structural Mechanics Research Lab.). [Nov. 27, 1962]. Contract AT(45-1)-1350. 50p. (HW-SA-2845)

To be published in TID-7651, Proceedings of the AEC Symposium on Packaging and Regulatory Standards for Shipping Radioactive Materials, held in Germantown, Md., Dec. 3-5, 1962.

Design of fission product shipping containers provided with materials of known crushing strength between the cask and the impact surface is described. The cask containers thus provide a method for predicting the forces imposed on a cask for almost any drop height and any impact attitude. It is then possible to predict cask damage under specified conditions. (J.R.D.)

6363 AGRICULTURAL RESEARCH COUNCIL RADIOBIOLOGICAL LABORATORY REPORT NO. 4. London, Her Majesty's Stationery Office, 1961. 81p. 5s.

The quantity of Sr^{90} in milk produced in the United Kingdom during the first half of 1960 is given. During the late spring and early summer, cattle were grazing for the first time on herbage that had grown after the rate of fallout had been relatively low for several months; on the average, milk produced during the latter part of May and June contained 48% of the Sr^{90} observed 12 months earlier. The mean for the 12 months ending June 1960 was 10.3 $\mu\mu c/l$ or 8.4 $\mu\mu c/g$ Ca, about 15% less than the corresponding figure at the end of 1959. Samples taken after June indicated that the levels in milk continued to be much below those observed at the same time in 1959. In special areas where high rainfall and local agricultural conditions led to higher levels in milk, no consistent downward trend in the 12-month mean values was apparent by the end of June, but in May and June the results for half of the areas were less than two-thirds of those 12 months previously. The highest value for an area from which a continuous supply of milk has been available was 68.3 $\mu\mu c/l$ or 60.5 $\mu\mu c/g$ Ca. Results in 1958 showed that the effective delay period in the transfer of Sr^{90} from rain to milk during the spring and early summer was longer in the special areas than elsewhere. Thus the decreasing rate of fallout has not affected the 12-month mean values as rapidly as in the countrywide survey. The new results justify the expectation that the mean level in the total mixed diet of the population, as well as in milk, will be appreciably lower for 1960 than for 1959. (H.H.D.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

6364 (NYO-9720) DEVELOPMENT OF KRYPTON 85 AS A UNIVERSAL TRACER. PHASE I AND II. PREPARATION AND PROPERTIES OF KRYPTONATES. Annual Report. David Chleck, Richard Maehl, Orlando Cucchiara, Rajni Patel, and Edmund H. Carnevale (Parametrics, Inc., Waltham, Mass.). Mar. 26, 1962. Contract AT(30-1)-2757. 135p.

Kr^{85} was incorporated into a variety of solid materials by either or both of two methods. In the first the krypton is ionized and then impelled into the solid under the influence of a potential drop. In the alternative method the solid is placed in contact with the gas at high temperature and pressure. Diffusion of the gas into the solid takes place under these conditions. The parametric dependencies of quantity included by diffusion were derived from theory and verified experimentally. The quantity of krypton included by diffusion is directly proportional to the pressure, an exponential function of the temperature, and proportional to the square root of duration of contact. Solid sources prepared by either means display stability with time and temperature. The loss with time is correlated with surface reaction. At elevated temperatures krypton is only partially released, the fraction being a function of temperature. Since Kr^{85} is released from these sources during chemical reaction or physical removal of surface, widespread application for radiochemical analysis and corrosion and wear studies is feasible. The Kr^{85} is localized near the surface making possible high specific activities for surface usage together with the handling and safety advantages of low total activity. This surface location of the radioisotope combined with the temperature dependent loss makes possible the measurement of surface and interfacial temperatures. Numerous other applications to utilize the radiation and half life advantages of Kr^{85} are discussed. (auth)

6365 THIAMINE RETENTION IN FREEZE-DEHYDRATED IRRADIATED PORK. Endel Karmas, John E. Thompson, and David B. Peryam (Reliable Packing Co., Chicago). Food Technol., 16: 107-8(Mar. 1962).

Ground pork in fresh, dehydrated, and dehydrated-rehydrated form was irradiated in the frozen state with 1.0, 2.5, and 4.5 megarad with a spent-fuel-rod source. In frozen fresh control pork the initial thiamine content was 0.960 mg/100 g and after irradiation it decreased sharply. Only 12% of the initial thiamine level was retained at the accepted sterilization dose of 4.5 megarad. Removal of water increased the retention of thiamine. About one-third of the initial thiamine content was destroyed by the freeze-dehydration process, but destruction of the thiamine was negligible throughout the entire irradiation range. Thiamine levels fell in dehydrated-rehydrated pork to the same extent as in fresh samples. The results show that dehydration before irradiation is beneficial to thiamine retention in pork. Destruction of thiamine in fresh irradiated pork is not a direct effect of irradiation upon the thiamine molecule but of an oxidation reaction caused by free radicals released from tissue water. (H.H.D.)

6366 GAS FLOW MEASUREMENTS BY THE TOTAL-COUNT METHOD. B. A. Fries (California Research Corp., Richmond). Intern. J. Appl. Radiation Isotopes, 13: 277-80(June 1962) (In English).

Simple equipment and procedures for storing, dispensing, injecting, and counting krypton-85 are described for gas-flow measurements by the total-count method. A sample stream from the gas line being measured is passed through a counting chamber at atmospheric pressure, and the radioactivity is counted with a thin-walled β-ray tube. An example of a flow-rate and a leak-rate measurement in an industrial plant is given. (auth)

6367 TREATMENT OF MEATS WITH IONISING RADIATIONS. X. THE IRRADIATION PRESERVATION OF PORK SAUSAGES. B. Coleby, M. Ingram, D. N. Rhodes, and H. J. Shepherd (Low Temperature Research Station, Cambridge, Eng.). J. Sci. Food Agr., 13: 628-33(Dec. 1962).

The storage characteristics of commercial pork sausages were considerably improved by irradiation at a dose of 1 Mrad, while only minor immediate changes in appearance and flavor occurred. The onset of microbial spoilage was delayed at 1° from 3 to 10 weeks, at 10° from 10 to 37 days, and at 15° from 7 to 24 days. During storage at 1° in the absence of air, no change in organoleptic quality was detectable up to 10 weeks and when sausages were removed from 1° after shorter periods their subsequent storage life at 10 or 15° was correspondingly lengthened. Rancidity developed rapidly in the sausages when irradiated and stored in air, even at 1°. It concluded that irradiation pasteurization offers useful possibilities in extending the storage life of conventional pork sausages if packed in oxygen-impermeable containers, or if suitable antioxidants are incorporated in the ingredients. (auth)

6368 STUDY OF THE DOSE-DEPENDENCE ON THE SURVIVAL RATE AND THE SEXUAL STERILIZATION OF THE GRANARY WEEVIL (CALANDRA GRANARIA). S. V. Andreev, B. K. Martens, V. A. Molchanova, and A. S. Stepanov (All-Union Scientific Research Inst. for Plant Protection, Leningrad). Radiobiologiya, 2: 758-62(1962). (In Russian)

The so-called cold sterilization method involving the use of γ-radiation for the large-scale extermination of pests which cause great damage to grain stored in granaries and elevators, presents serious economic problems; it is therefore very important to determine the optimum dose. In order to determine the lowest industrially usable dose, studies were carried out on the mortality, sterility, and the reduction of the biological activity of the granary weevil. A 50 g equivalent $Ra\text{-}Co^{60}$ source was used for the tests, regulating the dose by adjusting the distance. Groups of insects were exposed to 0.r, 1, 8, 12, 20, and kr of radiation. The results have indicated that exposure to doses between 0.5 and 1 kr exerts partial lethal and sterilizing action; complete sterilization is reached at about 8 kr. These values are useful for designing industrial apparatus for protecting the stored grain against depredations of the granary weevil. (TTT)

6369 RADIOAKTIVNYE IZOTOPY I YADERNYE IZLUCHENIYA V NARODNOM KHOZYAISTVE SSSR. (Radioisotopes and Nuclear Radiation in the National Economy of USSR). Proceedings of the All-Union Conference, Riga, April 12-16, 1960. Volume I. N. A. Petrova, L. I. Petrenko, and P. S. Savitskii, eds. Moscow, Gostoptekhizdat, 1961. 340p.

Fifty papers are included on industrial applications of radioisotopes and nuclear radiation in the USSR. The papers deal with current data on the development of radiation chemistry and radioisotopes in the chemical and oil refining industries. Descriptions are given of devices using radiation sources for testing, control, and automation. Safety problems in handling radioactive materials are also discussed. (R.V.J.)

6370 PRODUCTION OF SHORT-LIVED RADIOISOTOPES IN THE UNITED KINGDOM AND THEIR DISTRIBUTION. C. Taylor, R. West, and M. Whiting (Atomic Energy Research Establishment, Harwell, Eng.). IAEA Preprint SM-32/4. 18p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

Short-lived radioisotopes are produced centrally in the United Kingdom and distributed to laboratories at considerable distances, in many cases overseas. Most of these radioisotopes are produced in two research reactors at Harwell which are fitted with a variety of load-unload devices for carrying out short irradiations without interfering with reactor operation. The design and use of such devices is discussed, with reference to nuclear heating, sample containment, sample selection and handling, and reactivity effects. A review is given of the problems of distributing short-lived radioisotopes from a central supply point. (auth)

6371 SHORT-LIVED RADIOISOTOPE PRODUCTION, PROCESSING, DISTRIBUTION AND APPLICATIONS IN KOREA. Chong Kuk Kim (Atomic Energy Research Inst., Seoul, Korea). IAEA Preprint SM-32/8. 6p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The production, processing, and distribution of short-lived radioisotopes by the Atomic Energy Research Institute of Korea are discussed. The radioisotopes concerned are Na^{24}, Cu^{64}, K^{42}, Mo^{99}, W^{187}, colloidal Au^{198}, Br^{82m}, and I^{128}. Applications of these isotopes in various fields in Korea are discussed. The most important application is the use of Na^{24} for the detection of leaks in irrigation water storage containers. Since there are nearly 1500 such containers in South Korea, the detection of leaks is a nation-wide problem. Na^{24} is also applied to metabolic studies in hypertension and to the study of the mixing mechanism in miscible liquid-liquid phase systems. (auth)

6372 SHORT-LIVED ISOTOPES USED AS TRACERS IN INDUSTRY (WITH SPECIAL REFERENCE TO SWEDISH INDUSTRY). L. G. Erwall, H. G. Forsberg, and K. Ljungren (Technical Isotopes Lab., Stockholm). IAEA Preprint SM-32/13. 22p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

Typical examples of applications of Na^{24}, Cl^{38}, K^{42}, Mn^{56}, Br^{82}, La^{140}, and Au^{198} are given. Examples include studies of the transport of solids through process units, determination of flow rates for liquids in tubes and open streams, determination of residence times and blocked volume for liquids in process units, isotope dilution techniques, origin of non-metallic inclusions in steel, labeling for quality identification, efficiency of mixers in concrete industry, mapping of flow in sewage or waste water receivers, and detection and localization of leaks. (W.D.M.)

6373 STUDIES WITH SHORT-LIVED RADIOISOTOPES IN THE CHEMICAL PROCESS INDUSTRY. K. Fruehauf (Farbwerke Hoechst A. G., Frankfurt am Main). IAEA Preprint SM-32/14. 15p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

In the past five years Farbwerke Hoechst AG has used the following radioisotopes in evaluating performance characteristics of chemical production plants: Na^{24}, Mn^{56}, Cu^{64}, Br^{82}, Y^{90}, I^{132}, Ba^{137m}, La^{140}. Labelled particles were prepared for measurement of liquid flow in pipes and reactors, and for the investigation of grain movement in a rotary kiln. In the same manner pebble movement in a crude oil cracker was studied. For measuring distribution and residence time of liquids in reactors, injections of labelled solutions were made into aqueous, organic, and organometallic media. Similar methods were applied for the determination of mixing time and contents of storage containers, for leak detection and an examination of dyestuff washing in a filter press. The activities required were produced mainly by irradiation in FRF, the 50 kW homogeneous reactor of Frankfurt University. As an example of the application of an isotope generator in the chemical process industries, an extraction device for the repeated preparation of several millicuries of Ba^{137m} (2.6 min) in a high-boiling organic solvent is described. (auth)

6374 STUDIES OF POWDER MIXING WITH SHORT-LIVED RADIOISOTOPES. I. Bjerle (Stockholm Siporex Mfg. Co.) and H. G. Forsberg. IAEA Preprint SM-32/15. 15p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

Many industrial processes involve the mixing of the powders to form homogenous products. If the mixing conditions are not well established the mixing units will not be used to their best advantage. Radioisotopes are often used in determining optimum mixing conditions. The statistical nature of radioactive decay simplifies the treatment of the data obtained. The theory and application of some useful statistical methods are described. As an example, the mixing of light concrete from cement powder, aluminium powder, sand, and water is described. This is a severe mixing problem as mixing must occur before the reaction between water and aluminium, which gives the typical light-concrete structure, takes place to any considerable extent. Samples of aluminium powder and cement powder are activated in a reactor and are then used as radioactive tracers for the 5 m^3 batches of mixture. The behavior of the aluminium powder is studied using the nuclide Mn^{56} which is produced from manganese impurities in the aluminium. If certain precautions are taken, it is possible to use this nuclide in spite of its short half-life. In the case of cement powder, use is made of the nuclides Na^{24} and K^{42} which are formed in this material. (auth)

6375 SOME RECENT APPLICATIONS OF SHORT HALF-LIFE RADIOISOTOPES IN AUSTRALIA. J. S. Watt (Australian Atomic Energy Commission, Sutherland). IAEA Preprint SM-32/19. 20p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes

Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The use of short-lived radioisotopes in some of the field investigations recently carried out by the AAEC is described. A radioisotope technique is being developed to trace air movements in clouds, principally for use in experiments relating to cloud seeding. A technique is being developed for air pollution studies, especially for determining where particulate matter from a stack is deposited on the surrounding ground. A method for detection of leaks in town gas distribution systems and the use of gold-198 to trace fly ash after its discharge into the ocean are briefly described. (auth)

6376 APPLICATION OF SHORT-LIVED TRACERS TO FLOW-RATE MEASUREMENTS AND LEAK DETECTION. J. Guizerix and R. Cornuet (Centre d'Études Nucléaires, Grenoble, France). IAEA Preprint SM-32/21. 13p. (In French)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

A description is given of some experiments in which Na^{24} was employed to eliminate decontamination problems and to permit repitition of tracer injections. Experiments discussed include, leak detection in a central heating circuit, leak detection on a tank, determination of leakage flow-rate in a heat exchanger, and flow rate measurement on a high-pressure thermo-siphon. (W.D.M.)

6377 RADIOACTIVE TRACERS IN THE STUDY OF SUBTERRANEAN WATER FLOW. M. Birnbaum, E. Gaspar, L. Grigorescu, M. Oncescu, and P. Sandru (Inst. of Atomic Physics, Bucharest). IAEA Preprint SM-32/22. 15p. (In French)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The work of the Institute of Atomic Physics in Bucharest in the application of short-lived radioisotopes in hydrology is reviewed. The work has included the determination of fluid loss in main water pipes and investigation of the subinfiltrations of barrage. The main part of the paper is concerned with the determination of the direction and flow velocity of subterranean waters through a sandy medium rich in organic substances, situated on the shore of the Black Sea. A solution of NO_3La^{140} and $Na^{24}Cl$ of an activity of about 50 mc was used to which was added inactive material. The choice of La and Na cations was determined by the absence of clayey material from the studied medium. The solution was introduced into a central well, and its passage through other neighboring wells, spaced at distances of 1-5 m, was detected using submersible Geiger-Müller counters. The operation was repeated in several places in the region studied. The activity to be used as calculated, taking into account the efficiency of the detection apparatus, the dimensions of the portions of ground studied, the estimated value of the flow velocity, the eventual absorption of the tracer by the ground, and the maximum permissible levels of the radioisotopes in water. The results of the work have made void one of the presently held hypotheses in connection with the soiling by industrial residues of a fresh water lake situated in the vicinity. (auth)

6378 MEASUREMENT OF THE SPECIFIC GRAVITY OF THE WATER-STEAM EMULSION FLOWING IN A SCREEN TUBE OF AN INDUSTRIAL BOILER USING SODIUM-24. C. Maille (Société Stein and Roubaix, Paris), J. Moinard, D. Blanc, and J. Fontan. IAEA Preprint SM-32/24. 18p. (In French)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

The circulation inside an industrial boiler depends on the flow-rate and on the specific gravity of the water-steam emulsion. Conventional methods for measuring flow-rate in screen tubes require complex devices and may disturb the phenomenon under study. The employment of an external radioactive source and detector for densitometry measurements is simple and in common use. Unfortunately, it is difficult to use in the present case. A method consisting of the introduction of a calculated amount of sodium-24 into the boiler water is described. This very simple device does not disturb the flow. The experimental design is described. Sodium-24 gives consistent results, although less accurate than the densitometric process using an external source of Co^{60}. Investigations are now being made on a series of parallel tubes with the geometry used in industrial boilers. (auth)

INSTRUMENTS AND INSTRUMENTATION

General and Miscellaneous

Refer also to abstracts 6529, 6671, 7126, 7350, 7542, 7555, and 7593.

6379 (61-RL-2501G(Rev.)) A SMALL, SENSITIVE, BAKEABLE MASS SPECTROMETER. W. D. Davis and T. A. Vanderslice (General Electric Co. Research Lab., Schenectady, N. Y.). Apr. 1961. 12p.

A small, portable, magnetic, deflection-type mass spectrometer with a secondary emission multiplier was built for studying residual gases at ultra-high vacua and making transient pressure studies. Because of its small size, it has the advantage that it can be sealed directly to the tube or system being investigated and is easily tranportable. The spectrometer may be baked out at temperatures of 450°C. The design consists of a 90 degree sector, 5 cm radius of curvature, magnetic analyzer which will resolve adjacent mass peaks up to about mass 140. A Nier-type ion source is used and the ion detector is a 10-stage electron multiplier with a gain of 10^7. Partial pressures of 10^{-13} mm Hg were measured under normal operating conditions, and by cooling the multiplier in liquid nitrogen, pressures of the order of 10^{-15} mm Hg are measurable. By use of the multiplier, the signal level is raised to a point at which a low output load resistance may be used to get a short response time. This makes it possible to scan a large mass range and display the spectrum on an oscilloscope. Different ion species may thus be observed almost simultaneously during the course of transient phenomena. Sweep rates as high as 1.5 microseconds per mass unit were used successfully. (auth)

6380 (AAEC/TM-158) AN ANALYSIS OF INSTRUMENTAL ERRORS AFFECTING THE PERFORMANCE OF A SCHULTZ-TYPE TEXTURE GONIOMETER. J. W. Kelly (Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Oct. 1962. 14p.

The performance of a Schultz-type texture goniometer is shown to be adversely affected by a number of experimental errors all of which result in defocusing of the diffracted beam. These errors result from the tilting of the specimen, from lack of precision in positioning it, and from its absorption coefficient. An experimental procedure is outlined which minimizes these errors and results in optimum performance of the instrument. (auth)

6381 (AD-254402) SOVIET NUCLEAR INSTRUMENTATION AND CONTROL FOR PROPULSION. Monthly Report No. 3, February 1961. (Library of Congress. Air Information Div., Washington, D. C.). Mar. 15, 1961. 15p. (AID-Report-61-34)

A review is presented of development in the areas of electronic equipment, detectors, hydraulic control components, properties of irradiated insulation materials, and use of microthermocouples. (J.R.D.)

6382 (APDA-149) EVALUATION OF THE BLAKE SODIUM RESISTIVITY METER. (Atomic Power Development Associates, Inc., Detroit). Oct. 15, 1962. Contract AT(11-1)-865. 41p.

An exploratory evaluation of the Blake Resistivity Meter, designed to monitor contamination level in liquid-metal systems, was conducted. The meter was tested extensively in an experimental liquid-sodium loop to establish signal stability under system variables, and it was successfully calibrated for the determination of oxide concentration in the 10-80 ppm range. Gas entrainment was detected at a concentration of 500 ppm by volume. It was concluded that the meter is reliable and suitable for service in radioactive environments. Recommendations are made for the improvement of signal stability as well as for extending the range of the meter to make it suitable for commercial applications above 600°F. (auth)

6383 (BNL-5866) BUBBLE DENSITY IN A HYDROGEN BUBBLE CHAMBER. B. Sechi Zorn and G. T. Zorn (Brookhaven National Lab., Upton, N. Y.). Dec. 21, 1961. Contract [AT(30-2)-Gen-16]. 15p.

Gap-length measurements on tracks in a hydrogen bubble chamber have been used to determine the bubble density. The velocity dependence of the bubble density in the range $\beta = 0.60$ to 0.98 is shown to be represented by $1/\beta^{1.8 \pm 0.6}$. No relativistic rise in bubble density is found and this is in agreement with theoretical predictions. Mechanisms for bubble formation are discussed. (auth)

6384 (CEA-2143) ÉTUDE ET RÉALISATION D'UN GÉNÉRATEUR ÉLECTROSTATIQUE A TRÈS HAUTE STABILITÉ. (The Development of a Very High Stability Electrostatic Generator). Robert E. L. Jonckheere (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Grenoble). 1962. 102p.

Thesis submitted to Grenoble, France. Université.

A study was made of an electrostatic high-voltage generator having a voltage stability of the order of 10^{-4} per minute. This equipment can be used in electron microscopy. The electrostatic generator was studied as a control system element: transfer function, parasitic signals, and noise were determined and a mathematical model is proposed. A theoretical study of the openloop transfer function, stability, transient response, and voltage stabilization of five different control systems shows which one should be able to fulfill the requirements. A detailed study was made of drift. A description of the actual system and performance data are included. (auth)

6385 (CEA-2187) BALANCE DE TRANSLATION POUR LA MESURE DES SUSCEPTIBILITES MAGNETIQUES A HAUTE OU BASSE TEMPERATURE. (Translation Balance for Measuring Magnetic Susceptibilities at High or Low Temperatures. A. Blaise and M. A. Peuch (France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Grenoble). 1962. 20p.

A translation balance is described for the measurement of the magnetic susceptibilities of liquids or solids at 1.7 to 1,400°K. Measurements are made within a magnetic field adjustable from 3,400 to 16,000 oersteds, in any desired atmosphere. Susceptibilities between 10^{-3} and 10^{-4} u.e.m. C.G.S., can be measured. (auth)

6386 (CEA-2190) ETUDE ET REALISATION D'UN CALORIMETRE DIFFERENTIEL A COMPENSATION ELECTRIQUE POUR LA MESURE DES ECHAUFFEMENTS EN PILE. (The Development of an Electrically Compensated Differential Calorimeter for the Measurement of In-Pile Heat Evolution). Fernand Ayela and Henri Derrien (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1962. 33p.

A calorimeter was developed to determine the calorific

power produced by nuclear radiation in a given sample using simple electrical measurement. It also renders unnecessary all absolute measurements of temperature, all possible calibration, and the use of the thermal or thermoelectric constants of the constituent elements. The possible uses of the apparatus are varied, as shown by the in-pile experiments which were carried out and for which results are given. (auth)

6387 (CEA-2198) GENERATEUR D'IMPULSIONS ALEATOIRES APPLICATIONS A L'INSTRUMENTATION NUCLEAIRE. (Statistical Pulse Generator. Application to Nuclear Instrumentation). R. Beranger (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). 1962. 101p.

A random pulse generator adapted to nuclear instrumentation is described. After a short survey of the statistical nature of electronical signals the different ways for generating pulses with poissonian time-distribution were studied. The final generator built from a gaseous thyratron in a magnetic field is described. Several tests are indicated: counting-rate stability, Pearson's criterium, and distribution of time-intervals. Applications of the generator in "whole testing" of nuclear instrumentation are indicated for scalers, dead time measurements, and time analyzers. In this application, pulse-height spectrums were made by poissonian sampling of a recurrent or random low-frequency signal. (auth)

6388 (CERN-62-29) CERN 19 INCH CHASSIS SYSTEMS. B. Sagnell (European Organization for Nuclear Research, Geneva). Oct. 8, 1962. 72p.

The necessary information required to build and use the CERN 19-in. chassis system for electronic instruments is presented. Drawings and specifications are presented for the general chassis system, the plug-in chassis system, and the plug-in card system. (M.C.G.)

6389 (CERN-62-32) THE ANALYSIS AND DESIGN OF A FAST PULSE AMPLIFIER. H. Verweij (European Organization for Nuclear Research, Geneva). Oct. 30, 1962. 46p.

An amplifier is discussed offering a gain of ×10 and a rise-time of 2 nsec for a driving and load impedance of 125 ohm. It accepts either a positive or a negative input signal, but delivers simultaneously a positive and a negative output pulse of 7 v maximum. By way of a passive matched attenuator at the input, the gain can be decreased by 6, 12, or 20 db or combinations of these. A servo-circuit clamps the base line of the output signal, so that no d-c shift occurs for high pulse rates. Theoretical expressions were derived for the network parameters and the response. (auth)

6390 (DP-198) A SIMPLE LEAK DETECTOR FOR TRITIUM. Donald W. Colvin (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Jan. 1957. Contract AT(07-2)-1. 8p.

An ionization chamber of the integrating type was built that could detect a tritium leak rate of 10^{-13} cc per second within a few minutes, after a gas-collecting period of 16 hr. Electronic circuitry was avoided by using a quartz fiber voltmeter to indicate the rate of discharge of the chamber. (auth)

6391 (DP-663) ZIRCALOY CLADDING THICKNESS TESTERS. Leslie E. Goodwin (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Dec. 1961. Contract AT(07-2)-1. 16p.

A number of similar eddy current instruments were developed to measure the thickness of Zircaloy over U metal in the range of 5 to 25 mils, Zircaloy over UO_2 in the range of 20 to 40 mils, and the wall thickness of Zircaloy tubes in the range of 20 to 40 mils. The instruments were designed for use with hand-held probes or with feeder-mounted probes to measure the inside and outside cladding thickness of tubular elements and the wall thickness of Zircaloy sheaths. The instruments have a sensitivity of 3 microamps per mil change in Zircaloy thickness and an accuracy of ±1 mil. (auth)

6392 (GAT-T-973) MODIFICATIONS OF A COMMERCIAL CYLINDRICAL POWDER DIFFRACTION CAMERA FOR PRECISE AND ACCURATE LATTICE PARAMETER MEASUREMENTS. K. E. Beu, F. J. Musil, and D. L. Scott (Goodyear Atomic Corp., Portsmouth, Ohio). Feb. 19, 1963. Contract AT(33-2)-1. 11p.

A Philips 57.3 mm cylindrical powder camera has been modified to permit measuring diffraction line positions with a precision of about $0.002^{0}\phi$. These measurements can be corrected for systematic errors to obtain a comparable accuracy. The necessary modifications to achieve this precision and accuracy are described. (auth)

6393 (HW-SA-2300) MODIFICATION OF A SARGENT MODEL XXI POLAROGRAPH FOR CONTROLLED POTENTIAL POLAROGRAPHY AND VOLTAGE SCANNING COULOMETRY. R. W. Stromatt and F. A. Scott (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [1961]. Contract [AT 45-1 -1350]. 5p.

A conventional polarograph was modified using a potential controlling circuit. The resulting instrument can be used for controlled potential polarography or voltage scanning coulometry as well as for regular polarography. An operational amplifier is used to control the potential between a high impedance reference electrode and the mice (or controlled) electrode by forcing current through an auxiliary electrode. (M.C.G.)

6394 (HW-SA-2481) A TELEMETERING INSTALLATION TO REPORT COLUMBIA RIVER DATA BY RADIO. H. A. Kramer and J. L. Rand (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1, 1962. Contract [AT(45-1)-1350]. 14p.

Equipment was installed to measure water level and water temperature of the Columbia River. The telemetering equipment is described for radio transmission of this information over the 11 miles to Hanford. Description of a turbidimeter to be installed is also presented. (R.J.S.)

6395 (HW-SA-2510) INPUT AND SOURCE IMPEDANCE CORRECTIONS IN HIGH PRECISION AND VOLTMETER STANDARDIZATION. I. T. Myers and D. M. Fleming (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 20, 1962. Contract [AT(45-1)-1350]. 5p.

A method of standardizing digital voltmeters, voltage to frequency converters, and similar high resolution voltage-measuring equipment with standard cells is described. The effect of the standard cell internal resistance and of the input resistance of the voltage-measuring system is eliminated by auxiliary measurements. Corrections are made to ±0.001%. (auth)

6396 (JÜL-71-PP) RICHTLINIEN FÜR DEN BAU BETRIEBSSICHERER KONDENSATORBATTERIEN MIT NIEDRIGER INDUKTIVITÄT UN GROSSEM ENERGIEINHALT. (Guide Lines for Construction of Reliable Condenser Banks with Low Inductivity and High Energy Content). H. Fay and E. Hintz (Kernforschungsanlage. Institut für Plasmaphysik, Jülich, Germany). Oct. 1962. 15p.

The fundamental construction of a low-inductive condenser bank is described. Conditions for reliability with

regard to unintended electrical short circuits are discussed, including safety against short circuits before and after ignition of the spark gap and low-inductive construction of a bank safe against short circuits. Conditions for dependability with regard to the reliability of the spark gap used as the switch are also discussed. (M.C.G.)

6397 (JÜL-72-PP) EIN KOLLEKTORSYSTEM FÜR KONDENSATORBATTERIEN HOHEN ENERGIEINHALTES. (A Collector System for Condenser Banks of High Energy Content). H. Fay and W. Anger (Kernforschungsanlage. Institut für Plasmaphysik, Jülich, Germany). Oct. 1962. 40p.

The function and history of collector systems for condenser banks are described. The double-plate collector system is discussed. (M.C.G.)

6398 (KY-423) CONTINUOUS LEAK WATER SAMPLER. K. K. Mitchell and R. C. Baker (Union Carbide Nuclear Co. Paducah Plant, Ky.). Nov. 30, 1962. Contract W-7405-eng-26. 10p.

A water sampler which continuously samples a stream varying in depth from a few inches to several feet was developed and tested. The sampler cost less than $120 to construct, does not require a source of power, and may be left unattended for more than one week. (auth)

6399 (LNF-62/73) TUNNEL DIODE FAST DISCRIMINATOR CIRCUIT. Note No. 158. F. Pandarese and F. Villa (Italy. Comitato Nazionale per l'Energia Nucleare). Laboratori Nazionali, Frascati). Sept. 5, 1962. 10p.

A fast integral discriminator, employing tunnel diodes arranged in a bridge-like configuration, was examined. Diagrams and characteristics of the circuit are given. (auth)

6400 (MATT-110) VOLTAGE DOUBLER RECTIFIER. John G. Murray and Richard D. Farley (Princeton Univ., N. J. Plasma Physics Lab.). Jan. 15, 1962. Contract AT(30-1)-1238. 31p.

The voltage doubler rectifier provides an efficient means of supplying high voltage d.c. power. It is especially effective in charging pulsed loaded capacitors where high energy is involved. However, the analysis of the circuit and the sizing of components requires much more engineering analysis than other conventional rectifiers. To reduce the engineering time required, a means is provided of making a simplified approximation, which for most practical application is well within the accuracy required. (auth)

6401 (MATT-142) DETECTION AND LOCATION OF CAVITATION. C. P. Kittredge (Princeton Univ., N. J. Plasma Physics Lab.). Aug. 1962. Contract AT(30-1)-1238. 39p.

Simple low-cost hydrophones were constructed and used with good success in the detection of cavitation noise produced by water flowing in a pipe. Location of the noise was determined by analysis of records produced by a cathode ray oscilloscope with a camera attachment. The best results were obtained from oscilloscope traces which showed no noise preceding that produced by the nearly simultaneous collapse of a group of bubbles. (R.J.S.)

6402 (PUC-1962-56) A PENDULUM GRAVIMETER FOR MEASUREMENT OF PERIODIC ANNUAL VARIATIONS IN THE GRAVITATIONAL CONSTANT (thesis). William F. Hoffmann (Princeton Univ., N. J. Palmer Physical Lab.). Jan. 1962. Contract AT(30-1)-937. 123p.

A precise stable pendulum gravimeter was developed. This instrument was used to measure periodic annual variations in the earth's gravitational field. A description of the instrument and an analysis of the data are presented. It was concluded that the amplitude of any annual variation of the gravitational constant, is less than 4 parts in 10^3. (auth)

6403 (RADC-TDR-62-254) GAS DUPLEXER (PINCH EFFECTS). Quarterly Progress Report No. 3, January 1, 1962–March 31, 1962. Charles S. Ward (Microwave Associates, Inc., Burlington, Mass.). Contract AF30(602)-2401. 20p. (AD-276906)

The discharge arc loss and recovery time of a typical S-band encapsulated window was measured as a function of transverse magnetic field for varying fill pressures of spectroscopically pure Ar. These measurements were made at a peak power of 125 kw, a three μsec pulse width, and a 0.001 duty cycle. The d-c magnetic field was placed perpendicular to the narrow sides of the waveguide and therefore perpendicular to the microwave electric field. Reductions in both discharge arc loss and recovery time were observed resulting from the magnetic field. A magnetic field duplexer window, using quartz cylinders, was developed. This window has the desired 7% bandwidth at 2800 Mc and the low level insertion loss was less than 0.1 db. The window will handle at least 10 Mw peak–10 kw average under the specified duplexer conditions. (auth)

6404 (SCTM-168-60(24)) MICROSECOND TIMER DESIGN CONSIDERATIONS. J. A. Arnold (Sandia Corp., Albuquerque, N. Mex.). June 1960. Contract [AT(29-1)-789]. 23p.

Techniques for designing a transistorized μsec time interval measuring device are described. Particular emphasis is placed on minimizing its sensitivity to environmental noise. (auth)

6405 (SCTM-364-61(73)) CIRCUITRY AND RECORDING EQUIPMENT USED WITH VARIABLE-RESISTANCE METALLIC STRAIN GAGES. P. H. Adams and R. C. Dove (Sandia Corp., Albuquerque, N. Mex.). Sept. 1962. Contract [AT(29-1)-789]. 72p.

The basis circuits that are used in electric resistance metallic-strain-gage work are discussed. Sensitivity equations are developed; methods for calibrating, balancing, and temperature-compensating circuits are covered. The effects of lead wires, switches, and slip rings that may be present in the circuit are considered. Equipment that is used for indicating and recording strain-gage signals is discussed. Items include: strain indicators, oscillographic and oscilloscope recorders, magnetic-tape recorders, and telemetry. Principle of operation and limitations are emphasized. (auth)

6406 (TID-13148) A REFLECTING MICROSCOPE FOR TEMPERATURES TO ABOVE 2500°C. D. M. Olson, B. B. Brixner, and M. C. Smith (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-eng-36]. 23p. (LADC-4906)

A microscope is described whose objective is a concave ellipsoidal mirror, and in which specimens can be examined visually or photographed at 30X to 600X, in vacuum or controlled atmosphere, at any temperature from ambient to above 2500°C. (auth)

6407 (TID-15453) STERILIZATION—AN EXAMPLE OF RELIABILITY IMPROVEMENT THROUGH MONITORING. William F. Jemison (Sandia Corp., Albuquerque, N. Mex.). Mar. 26, 1962. Contract [AT (29-1)-789]. 32p. (SCDC-2602X)

Sterilization in monitoring consists of sensing an unwanted or dangerous situation in a circuit and rendering the circuit impotent. It is shown that in a single-channel system sterilization will control unwanted or dangerous situations at the expense of no output. In a dual channel system sterilization will control unwanted or dangerous

situations and also considerably increase reliability. It is shown that the system is almost as reliable as a series-parallel net and is considerably reduced in size and weight. (auth)

6408 (UCRL-6531) SOME SOLUTIONS FOR INTERNAL HIGH-PRESSURE INSTRUMENTATION PROBLEMS. R. V. Ramage (California. Univ., Livermore. Lawrence Radiation Lab.). June 29, 1961. Contract W-7405-eng-48. 13p.

The design and fabrication of leads having up to twenty-four electrical wires for internal instrumentation of high-pressure vessels are described. Commercially available hardware and plastics are used. The leads are in routine use for pressures in excess of 50,000 psi. A variety of techniques, dependent on the temperatures involved, are detailed. (auth)

6409 (UCRL-6793) "PROTOGRAPHY" WITH MOLYBDENUM TRIOXIDE, A METHOD OF HYDROGEN DETECTION. Edmund S. Chambers (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 20, 1962. Contract W-7405-eng-48. 9p.

Sufficiently energetic neutral or ionic H atoms or molecules striking MoO_3 effect a color change from pale yellowish white to blue or gray. Images of neutrals and ions have been formed on a film of MoO_3. These images are useful in determining the spatial distribution of the striking particles. A calibration was made for H^+ and H_2^+ at 4 to 14 kev. A total charge density of 10^{-3} coul/cm^2 gave an optical density of 0.44 on the MoO_3 film. A way to filter out low-energy particles is mentioned. (auth)

6410 (UCRL-9807) CALIBRATION OF BRIDGMAN ANVILS, A PRESSURE SCALE TO 125 KBARS. Peter W. Montgomery, Harold Stromberg, George H. Lura, and George Jura (California. Univ., Berkeley. Dept. of Chemistry and California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 1961. Contract W-7405-eng-48. 32p.

It is shown that a radial pressure gradient exists in the silver chloride when it is used as the pressure-transmitting medium in Bridgman anvils. The gradient can be obviated by the use of circular sections of wire. The center of curvature of the wire hoop is made coincident with the anvil center. When the inner and outer diameters of the pyrophyllite retaining ring are $\frac{1}{2}$ and $\frac{7}{16}$ in., respectively, the pressure, P, is P = (0.725 + 0.468R) L, where R is the fractional displacement from the center and L is the average pressure as determined from the total load and area of the anvil face. This relation appears to be valid to 125 kbars. The Bi 6-8 transition is found to occur at 88 ± 3 kbars. (auth)

6411 (WADD-TR-60-371) A SOURCE AND DETECTOR OF RADIATION IN THE WAVELENGTH REGION 1500-50 ANGSTROMS SUITABLE FOR RADIATION EFFECTS STUDIES ON MATERIALS IN VACUO. Horace R. Moore (Electro-Optical Systems, Inc., Pasadena, Calif.). Apr. 1961. Contract AF33(616)-6488. 41p. (AD-267410)

A source and detector of vacuum ultraviolet radiation in the wavelength range from 50 to 1500 Å which are being developed for radiation-effects studies on materials in vacuo are described. The principle of the radiation source is the repetitive pulsed discharge of capacitor stored energy into a ceramic discharge tube. A very hot plasma is thus generated which omits vacuum ultraviolet radiation by Bremsstrahlung-like processes. The principle of the radiation detector is photoelectric emission from a photocathode exposed directly to the radiation in vacuo. The pulsed output current from the multiplier phototube is measured with a finite integrator. The radiation source and detector were designed to be finally incorporated in an environmental test chamber capable of being evacuated to a working pressure of 10^{-9} mm Hg. (auth)

6412 (SCL-T-447) DETECTION AND STUDY OF IONIZATION IN INDUSTRIAL DIELECTRICS. F. Viale. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.) from Rev. Elec. Mecan., No. 96, 28-40(1954). 13p.

The detection of ionization discharges in a dielectric is discussed. The principles of ionization detection are reviewed. The instruments for measuring the ionization, cathode oscillographs, and peak millivoltmeters, are described. The correlation between the measured impulse of the voltage which appears at the terminals of the measuring impedance and the ionization is shown. (M.C.G.)

6413 (SCL-T-449) ATTAINING RADIOSPECTROSCOPE LIMIT SENSITIVITY FOR OBSERVATION OF ELECTRON PARAMAGNETIC RESONANCE. V. A. Atsarkin, M. E. Zhabotinskii (Zhabotinskiy), and A. V. Frantsesson. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.) from Radiotekhn. i Elektron., [7]: 866-73(May 1962). 15p.

The basic sources of noises which restrict the sensitivity of a paramagnetic radiospectroscope were examined. A comparison of radiospectroscopes of different systems was made and it was found that the maximum sensitivity is assured by a superheterodyne circuit with a double modulation of the magnetic field, and with a system consisting of an automatic installation of the generator frequency in the operating resonator. The latter system was thoroughly analyzed. It was shown that, with a correct projection, this system assures a suppression of noises caused by the instability of the frequency oscillations in the signal generator. The circuit of an operating superheterodyne radiospectrograph was also examined; its sensitivity amounts to 2×10^{-12} g-mol of DPH (diphenylpicrylhydrazyl) in the presence of an effective band of frequencies passed through the receiver and amounting to 2 cycles. (auth)

6414 FOCUSING PROPERTIES OF A SPECTROMETER FIELD OF THE FORM $r^{-1}\sin^{-1}\Theta$. F. Heinrich and A. Hofmann (Eidgenossische Technische Hochschule, Zurich). Helv. Phys. Acta, 35: 321-2(1962). (In German)

Equations giving the focusing properties of a spectrometer field of the form $r^{-1}\sin^{-1}\vartheta$ were derived by replacing time in the motion equations by the parameter ψ. The equations show that r is periodic in ψ and $\Delta\phi$ is independent of r_0 and of the initial value ψ_0. An approximation solution was treated which describes the orbits with small deviations from the plane $\vartheta = \pi/2$. Solution of the differential equation of the motion in ϑ showed that for fixed values of K an additional focusing of the first order exists in the ϑ coordinates. Some unstable solutions of the differential equation are tabulated. (J.S.R.)

6415 NATURAL RADIOACTIVITY IN SOME ELECTRONIC COMPONENTS AND IN A SAMPLE OF GLASS. J. Rundo (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Appl. Radiation Isotopes, 13: 515-16(Sept. 1962). (In English)

Radioactivity measurements made with a NaI(Tl) crystal are reported for some electronic components from a head amplifier. The amplifier in toto gave a net rate of 138 cpm above a bias of 25 kev, and the gamma spectrum showed lines due to K, Ra^{226} daughters, and Th^{232} daughters. The count rates from the valves, ceramic capacitors, and four different types of resistors of the amplifier are tabulated, and approximate activities were estimated. Radioactivity

measurements are also reported for a glass window from a large cloud chamber; both Ra^{224} and Ra^{228} daughters were detected. (D.L.C.)

6416 ON THE FEASIBILITY OF PRODUCING A RADIOFREQUENCY MASS SPECTROMETER WITH PARABOLIC DISTRIBUTION OF THE POTENTIAL. S. I. Pavlov and V. I. Rakhovskii. Izmeritel. Tekhm., No. 7, 50-1(July 1962). (In Russian)

The operational difficulties of a radiofrequency mass spectrometer with ion separation achieved by their free oscillation periods in an electric field with parabolic distribution of the potential (where the mass spectrometer with a series of diaphragms is supplied by certain potentials from the divider producing parabolic potential distribution) were analyzed. (R.V.J.)

6417 SINGLE-CRYSTAL NEUTRON DIFFRACTION EQUIPMENT AT THE DIDO REACTOR. B. T. M. Willis (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Sci. Instr., 39: 590-2(Dec. 1962).

A description is given of the single-crystal equipment which has been in continuous operation at the DIDO reactor for the past two years. Two diffractometers are used on the same reactor hole and each employs a copper monochromator reflecting neutrons of wavelength 1.04 Å through 90°. The advantages of this high reflecting angle are discussed. (auth)

6418 CURRENT SHIMS FOR HIGH-RESOLUTION NUCLEAR MAGNETIC RESONANCE ON THE PROBLEM OF CORRECTING MAGNETIC FIELD INHOMOGENEITIES. I. Zupančič (Nuclear Inst. J. Stefan, Ljubljana, Yugoslavia). J. Sci. Instr., 39: 621-4(Dec. 1962).

In nuclear magnetic resonance experiments, magnets are needed with the highest possible homogeneity of magnetic field throughout the volume of the probe. The problem of how to reduce the effects of inhomogeneities by spinning the sample and by using current shims is discussed. The magnetic field inhomogeneities are expanded in spherical harmonics, and the terms cancelled by sample spinning determined. It is shown that current shims in the form of pairs of straight wires placed symmetrically on both pole pieces are able to compensate inhomogeneities not averaged out by spinning the sample. (auth)

6419 THE X-RADIOGRAPHY OF RADIOACTIVE SPECIMENS USING A ROTATING LEAD DISK WITH COLLIMATING SLITS. K. M. Swanson and A. G. Kerswell (Dounreay Experimental Reactor Establishment, Caithness, Scotland). J. Sci. Instr., 39: 642-4(Dec. 1962). (TRG-Report-246)

A rotating lead disk with radial collimating slits is placed between the active specimen and the x-ray film. The factor which determines whether the radiograph will be fogged by gamma rays then becomes the activity per unit length of the specimen rather than the total activity. The successful reduction of background fogging by the device is demonstrated. The extension of radiography to the study of very highly active specimens is indicated. (auth)

6420 A SEMI-AUTOMATIC DEVICE FOR MEASURING OSMOTIC PRESSURES. Cl. Lucarain (Centre d'Études Nucléaires, Saclay, France). Rev. Franc. Etudes Clin. Biol., 7: 213-15(1962). (CEA 2171). (In French)

A cryoscope for measuring osmotic pressure in small samples (0.1 ml) is described. The sample is frozen by air-cooled dry ice or liquid N_2; the temperature is measured by a thermistor resistance and a recording millivoltmeter. (auth)

6421 APPLICATIONS OF MODULATION TECHNIQUES TO HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE SPECTROMETERS. Weston A. Anderson (Varian Associates, Palo Alto, Calif.). Rev. Sci. Instr., 33: 1160-6(Nov. 1962).

An NMR spectrometer system is described which incorporates the use of magnetic field modulation for the simultaneous purpose of baseline stabilization and stabilization of the resonance condition. Several other modulation techniques are briefly described. (auth)

6422 ALPHA GAUGE FOR THE MEASUREMENT OF SMALL DENSITY THICKNESSES. R. P. Gardner and H. H. Ross (Oak Ridge Inst. of Nuclear Studies, Tenn.). Rev. Sci. Instr., 33: 1227-30(Nov. 1962).

An alpha-particle gage was developed based on a transmission, total-count principle. In consists of a thick alpha source and a surface-barrier detector. This simple combination eliminates many of the practical disadvantages of previous alpha-gage systems. Without mechanical or electronic adjustment, air density can be measured with a 1-sec time constant over the range from 0 to 1.1 mg/cm^3 with a maximum standard deviation of 5.9×10^{-4} mg/cm^3. (auth)

6423 A 25-INPUT PULSE-HEIGHT RECORDING SYSTEM. D. E. Groom and J. H. Marshall (California Inst. of Tech., Pasadena). Rev. Sci. Instr., 33: 1249-55(Nov. 1962).

A general description is given of a data recording system which provides a link between counter experiments in high-energy physics and a high-speed digital computer. The instrument described can accept as many as 25 simultaneous photomultiplier tube signals and pulse-height analyze them into 100 channels each. Six bits of digital data may be substituted for any unused pulse-height input. The usual output is perforated paper tape with a binary coded decimal format for use with a Burroughs 220 computer. Identification words can be set up and recorded on the tape. The speed of the paper tape perforator limits the rate of analysis to one event per second. If the output data are fed directly into a computer memory, then the recording rate can be increased to 60 events per second. The instrument has been in operation since December 1961, and results obtained with it using both particles produced by the Caltech synchrotron and pulsers are given. Only solid-state components have been used, including nearly 1700 transistors and an equal number of diodes. (auth)

6424 HIGH FIELD GAUSS METER FOR USE AT LIQUID HELIUM TEMPERATURES. M. W. Dowley (IBM Research Lab., San Jose, Calif.). Rev. Sci. Instr., 33: 1290-1(Nov. 1962).

The high-field magnetoresistance of polycrystalline Bi wire was determined in magnetic fields from 0 to 10 kG at room temperature, 77°K, and 4.2 to 1.3°K. In all cases, the resistance varied linearly with field for fields >2.5 kG, and the resistance change with field at ≤77°K was greatest for the perpendicular orientation. A small probe was made, and its resistance vs field plot at 4.2°K was linear from 5 kG with a slope of 24.6 Ω/kG. (D.L.C.)

6425 VACUUM CALORIMETRY IN EXPLODING WIRE STUDIES. M. Rabinowitz (Washington State Univ., Pullman). Vacuum, 12: 217-20(July-Aug. 1962).

A method of using vacuum calorimetry as a means of determining directly the energy deposited in an electrically exploded wire is presented. This energy determination is compared with that given by the time integral of the product of voltage and current. A definite reproducible pattern of the explosion products is deposited on the walls of the calorimeter, which may be used as a means of understanding the behavior of the wire during the explosion. (auth)

6426 ELEKTRONNYE PRIBORY YADERNOI FIZIKI. (Electronic Equipment in Nuclear Physics). A. A. Sanin. Moscow, Publishing House of Literature on Physics and Mathematics, 1961. 615p.

Descriptions are given of electronic equipment used in nuclear physics. A detailed account is given of various signal and current amplifiers, pulse and coincidence recording systems, and amplitude and time analyzers. A detailed analysis is given of the design and performance of linear amplifiers, electron tubes (diodes, triodes, pentodes, etc.), pulse amplifiers, coincidence and anticoincidence schemes, and calculation schemes. A reference list of electron devices, tubes, and parts manufactured in Soviet Russia is presented. 396 references are included. (R.V.J.)

6427 IMPROVEMENTS IN OR RELATING TO STANDARD LEAKS. Richard John Bayley Hadden and Albert Walter Kirk (to United Kingdom Atomic Energy Authority). British Patent 913,051. Dec. 19, 1962. Filed July 25, 1960.

A standard leak comprises a synthetic resin plug adapted to be secured in a vacuum-tight manner to an opening in an evacuable system. A length of fiber-glass yarn containing a number of hollow filaments is molded into and extends through the plug. (R.J.S.)

6428 IMPROVEMENTS IN OR RELATING TO BALANCED ELECTRONIC CIRCUITS. Graham Lewin Godfrey and Arthur Blackley Gillespie (to United Kingdom Atomic Energy Authority). British Patent 913,138. Dec. 19, 1962. Filed Aug. 16, 1960.

A balanced electronic circuit is comprised of at least two long-tailed pair stages connected in cascade. The two output electrodes of each pair are coupled to the two input electrodes of the succeeding pair in the cascade. Each output electrode of the final pair is connected to a cathode-follower stage. Negative feedback is provided for input signals applied between the input terminals. (R.J.S.)

6429 IMPROVEMENTS IN AND RELATING TO MEANS FOR MEASURING STATIC GAS PRESSURES IN PRESSURE VESSELS. George White and Alan Bell (to C. A. Parsons and Co. Ltd.). British Patent 913,498. Dec. 19, 1962. Filed July 18, 1960.

Static gas pressure within a vessel is measured by means of a dead weight, the magnitude of which is variable, floating in a cylinder under gas pressure. A manometer, receiving a supply of gas from the vessel, measures the difference in gas pressure under the dead weight and the gas pressure in the vessel. (R.J.S.)

Radiation Detection

Refer also to abstracts 5732, 6494, 7067, 7118, 7119, 7120, and 7128.

6430 (BNL-763) EXTENDING THE RANGE OF THE "FRICKE" DOSIMETER UP TO 10^6 RADS. F. J. Haasbroek (Brookhaven National Lab., Upton, N. Y.). Apr. 1962. Contract [AT(30-2)-Gen-16]. 18p.

Two alternative methods to extend the upper range of the "Fricke" dosimeter continuously to 10^6 rads are presented. Dosimeter solutions containing higher Fe^{2+} concentrations are irradiated either while bubbled with oxygen or oxygen-free. For the oxygenated system $G(Fe^{3+})$ values of 16.1 and 15.6 are used for 5 mM and 20 to 50 mM Fe^{2+} solutions respectively. A $G(Fe^{3+})$ value of 8.0 was determined for the de-aerated system which appeared to be independent of Fe^{2+} concentration over the range 2 to 50 mM. Both methods are simple and the reproducibility is better than ±2%. (auth)

6431 (CEA-2036) MESURE DE L'ACTIVITÉ DES ÉMETTEURS GAMMA PAR CHAMBRES D'IONISATION. DÉTERMINATION DU COEFFICIENT SPÉCIFIQUE D'ÉMISSION GAMMA DE QUELQUES RADIOÉLÉMENTS (thèses). (The Activity of Gamma Emitters as Measured by Ionization Chambers. The Determination of the Specific Gamma Emission Coefficient for Some Radioelements (thesis). Jacques Engelmann (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). 1962. 64p.

Submitted to Université, Paris.

The object of this work is to study techniques of measurement using the gamma ionization chamber, making it possible either to measure the activities of radioactive sources, or to determine the specific emission coefficient γ (or the coefficient K) of a given radio-element. The ionization chambers studied belong to two categories: graphite cavity-chambers, and $4\pi\gamma$ chambers. For the cavity-chamber measurements, the different correction factors of which account must be taken have been calculated, in particular the geometric and hygrometric corrections. The absorption and autoabsorption corrections have led to the introduction of the notion of the effective energy, γ, of a radio-element. In the case of $4\pi\gamma$ chambers, it has been shown that appropriately shaped electrodes make it possible to improve their performances. One of the chambers described permits the measurement of β emitters using the associated bremsstrahlung. The K coefficients of some radio-elements were measured, using a graphite-coated $4\pi\gamma$ chamber, a radium standard was used for comparison. The validity of the method was checked with radio-elements for whom the K coefficient values are well-known (Na^{24}, Co^{60}, I^{131}, Au^{198}). For other radio-elements, the following values were obtained (expressed in r cm^2 mc^{-1} h^{-1}):

Cr^{51}: 0.18	Sb^{124}: 9.9	Ce^{141}: 0.46
Mn^{56}: 8.8	Cs^{134}: 9.3	Tm^{170}: 0.023
Zn^{65}: 3.05	Cs^{137}: 3.35	Ir^{192}: 4.9
		Hg^{208}: 8.18

These values have been corrected for the contribution to the dose of the fluorescent radiation which may be emitted by the source, except in the case of Tm^{170}. The performances of the different electrometric devices used were compared. (auth)

6432 (HW-66899) A LOGARITHMIC, TRANSISTORIZED COUNT-RATE-METER. D. P. Brown (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 14, 1960. Contract AT(45-1)-1350. 12p.

A logarithmic count-rate meter using transistors and silicon diodes was developed having logarithmic response over a range of 10^2 c/m to 10^6 c/m with an accuracy of better than ±10%. The stability with temperature changes is better than ±5% over temperature range 25 to 150°F. (auth)

6433 (HW-71354) SELF-POWERED RADIATION MONITOR AND ANALYZER. D. P. Brown and E. M. Sheen (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 2, 1962. Contract [AT(45-1)-1350]. 25p.

A description is presented concerning design and development of a portable instrument suitable for general radiation monitoring for various alpha-, beta-, and gamma-emitting radionuclides with gamma energy analysis possible when desired. Count-rate meter and scaler presentation of data is possible, and the instrument can be operated on its own power or on a line. (J.R.D.)

6434 (HW-73155) FUEL ELEMENT SURFACE CONTAMINATION (URANIUM) TESTER. C. N. Jackson, Jr. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 27, 1962. Contract AT(45-1)-1350. 11p.

A common problem of fuel-element fabricators is contamination on the outside of the fuel-element cladding. Control of this contamination by alpha counting is described. The alpha particles from the contamination U strike a ZnS scintillating decal directly fastened to lucite light pipes. The scintillation is piped to a photomultiplier which converts the signals to electric pulses for counting. The count rate is directly proportional to the amount of U on the fuel-element clad surface. (J.R.D.)

6435 (IEA-50) SELETOR DE TEMPO DE RETARDO DE 20 CANAIS END ANALISADOR DE TEMPOS DE RETARDO DE UM CANAL. (20-Channel Delayed Time Selector and One-Channel Delayed Time Analyzer). Raul Brenner (Brazil. Instituto de Energia Atômica, São Paulo). May 1962. 7p.

A 20-channel delayed time selector, designed to measure delayed spectra, is described. Its operation and characteristics are reported, and the circuit is given. The delayed time analyzer consists of two similar delay circuits which generate a rectangular wave of adjustable and precise length. The characteristics and circuit of the time analyzer are also presented. (J.S.R.)

6436 (IS-476) INFLUENCE OF FIELD SHAPE DEVIATIONS ON ELECTRON ORBITS IN MAGNETIC BETA-RAY SPECTROMETERS. H. Daniel and L. Jackson Laslett (Ames Lab., Ames, Iowa). June 1962. Contract W-7405-eng-82. 13p.

Computational results are presented for the effect of field errors on the resolution of two types of high resolution beta-ray spectrometers proposed previously, one type employing a curved exit slit and the second a shifted source. Specifically, results are reported for illustrative cases in which the coefficient (δ) of ρ^4, in the polynomial representing the magnetic field as a function of the distance from the equilibrium orbit, is assigned other than optimum values. In the case of the 324.5° curved exit slit spectrometer, for example, a resolution of the order of 10^{-4} is achieved for a fractional solid angle of transmission (rhombic distribution of emission angles) equal to 1.3% when δ is in error by 0.1, and a resolution of the order of 10^{-3} is obtained for a 2.7% solid angle and a 0.3 error in δ. The latter error in the coefficient δ corresponds to a field error of 0.077% at the extreme points of the selected orbits, and it is expected that a smaller error than this will result from the use of suitably designed field coils in a nonferromagnetic spectrometer of this type. (auth)

6437 (JÜL-69-ST) DER GEGENWÄRTIGE STAND DER PRAKTISCHEN NEUTRONENDOSIMETRIE. (The Present Position on Practical Neutron Dosimetry). D. Nachtigall (Kernforschungsanlage, Jülich, Germany). Sept. 1962. 27p.

The status of reasonably routine local-dose measurement methods is reported. The results of comparative measurements of the dose of fast neutrons with different apparatus and methods are shown to be insufficient. A method for the dosimetry of neutrons from the thermal region to 7 Mev is described. (tr-auth)

6438 (TID-15530) COMPTON SPECTROMETER: SYSTEM TIMING AND MAGNET CONTROL. Hans H. Cremer (Argonne National Lab., Ill.). Feb. 1962. Contract [W-31-109-eng-38]. 6p. (UAC-6104)

The timing and magnetic field controls for the Argonne Magnetic Compton Electron Spectrometer are described. To cover the desired energy range of the spectrometer the magnetic field had to be varied between approximately 100 and 1650 G. The field was stepped in 0.1% increments, with time intervals between steps adjustable from 40 sec to 150 min. The primary timing elements were synchronous motor driven timers with interchangeable timing gears. A Hall Generator was used to sense and control the field in the gap of the spectrometer magnet. A dual loop arrangement was used. (M.C.G.)

6439 (UCRL-5979) ALPHA AIR MONITORING WITH α/β RATIO COMPENSATION FOR NATURAL INTERFERENCE. C. L. Lindeken and D. N. Montan (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 5, 1962. Contract W-7405-eng-48. 22p.

Results are presented of a theoretical study to calculate the α/β ratio of filter-collected natural airborne radioactivity. The detection of airborne Pu contamination by noting increases in this α/β ratio is discussed. A modification of this approach which provides a more uniform response to alpha airborne contamination is described. (auth)

6440 (UCRL-10030) A THIN SEMICONDUCTOR TRANSMISSION-COUNTER SYSTEM FOR NUCLEAR PARTICLE DETECTION. Jack H. Elliott and Richard H. Pehl (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 24, 1962. Contract W-7405-eng-48. 13p.

Sturdy Si transmission counters as thin as 0.0012 in. were produced and used in conjunction with a passive pluse-adder circuit which combined the dE/dx and E pulses so that the nonuniformity and energy straggling in the transmission counter would not decrease the resolution of the energy spectra. Construction and performance of these counters are described. (auth)

6441 (USNRDL-TR-581) RADIATION EFFECTS IN THERMOELECTRICS. 1. TECHNIQUES FOR DETECTION OF TRANSIENT EFFECTS AND THEIR APPLICATION TO COMMERCIAL GRADE BISMUTH TELLURIDE. J. W. Winslow and R. R. Hart (Naval Radiological Defense Lab., San Francisco). Sept. 13, 1962. 85p.

Two satisfactory laboratory methods for detecting and studying transient radiation effects on Seebeck coefficient, S, and electric resistivity, ρ, of materials having large thermoelectric figures of merit, z, have been developed. The transient effects of intense beams of 2-Mev electrons on z in commercially available, thermoelectric grade Bi telluride, have been deduced from separate observations of S and ρ made using these methods, together with previously reported observations of thermal conductivity. These observations indicate that ionizing radiation has no transient effects on the point value of z, within experimental limits of accuracy amounting to ±50%. However, secondary effects very probably arising from inhomogeneity of the test material were observed. A simple model for, and some of the implications of, these observations are discussed. (auth)

6442 (USNRDL-TR-592) COMPUTER-AIDED ANALYSIS OF GAMMA-RAY SPECTROMETER DATA. P. A. Read and F. M. Tomnovec (Naval Radiological Defense Lab., San Francisco). Oct. 26, 1962. 24p.

Gamma ray pulse height distributions are analyzed with the aid of a computer. The method is based on a library of standard distributions punched on IBM cards. To reduce a pulse height distribution into discrete peaks, appropriate standards are chosen from the library, and adjustment factors are provided so that the computer can fit the standards to the distribution. It removes each fit successively from the distribution and leaves a record

thereof. The removal facilitates subsequent fits. The records comprise a set of reduced distributions from which can be deduced the gamma ray spectrum of the source which gave rise to the original distribution. (auth)

6443 (USNRDL-TR-598) A STANDARDIZATION OF THE HURST RADSAN NEUTRON DETECTOR. A. H. Redmond and M. B. Salamon (Naval Radiological Defense Labs., San Francisco). Nov. 19, 1962. 21p.

Dose measurements have been made with five Radsan detectors at the same operating conditions using a 100 channel analyzer and computing dose from the pulse height distribution. The detectors responded to an 80 gram Pu-Be neutron source at 50 cm with a sensitivity about 21% higher than the first collision dose computed from the spectral distribution. An explanation is offered. Responses to a 2 gram similar source mounted on the detectors were correlated with the counting rate on a scalar, giving a figure for a quick check of detector condition. Both measurements gave similar ratios of dose-to-counts in a 10 minute period. A shift of spectrum threshold with detector temperature rise is described. (auth)

6444 (AEC-tr-5259) SCINTILLATION METHOD IN RADIOMETRY. (Stsintillyatsionnyi Metod v Radiometrii). V. O. Vyazemskii, I. I. Lomonosov, A. N. Pisarevskii, Kh. V. Protopopov, V. A. Ruzin, and E. D. Teterin—B. V. Rybakov, ed. Translated by Lydia Venters (Argonne National Lab., Ill.) from (a publication of the State Publishing House for Atomic Energy and Technical Literature, Gosatomizdat, Moscow). 1961. 421p.

The basic principles of the scintillation method for recording and spectrometry of nuclear radiations and use of this method in various fields are discussed. Topics covered include: the scintillation method, scintillators and scintillation processes, photomultipliers and processes occurring in them, electronic devices in the scintillation method, gamma spectrometry, charged-particle spectrometry, scintillation methods for recording neutrons, and some applications of the scintillation method. (M.C.G.)

6445 OBSERVATIONS ON THE EFFECT OF CHAMBER SIZE ON MEASUREMENTS AT THE EDGE OF AN X-RAY BEAM. David Greene (Christie Hospital, Manchester, Eng., and Holt Radium Inst., Manchester, Eng.). Brit. J. Radiol., 35: 856-60(Dec. 1962).

Measurements were made with a 3 mm and a 6 mm diameter chamber to determine the dose distributions at the beam edge for 300 kvp radiation in air, under conditions of known geometry; for 300 kvp radiation in a water phantom where the beam was defined by a standard applicator; and for 4 Mv radiation in a water phantom. For the in air experiments it was possible to compare the geometrical penumbra, the calculated response of the chambers to the dose distribution, and the measured dose distribution. For a 20 Mv beam the dose distribution at the beam edge, as measured by the 6 mm diameter chamber, was compared with that determined by measuring induced activity in a copper strip irradiated in the same position. For the in air observations reasonable agreement was found between the calculated and experimental results. For the measurements made in water it was found that the two measuring systems used always gave the same information and, therefore, that the resolving power of the larger chamber was adequate. (auth)

6446 A CONTINUOUS FLOW BETA SCINTILLATION DETECTOR FOR AQUEOUS SOLUTIONS. R. Tkachuk (Board of Grain Commissioners for Canada, Winnipeg, Manitoba). Can. J. Chem., 40: 2348-56(Dec. 1962).

Counting of beta emitters in aqueous solutions was carried out with a detector whose detecting element is a packed column of a finely divided plastic scintillator. The efficiencies under practical operating conditions for C^{14}, $Sr^{90}-Y^{90}$, and K^{40} are 36, 74, and 82% at backgrounds of 27 ± 2 cpm. (auth)

6447 DETECTORS FOR MEASURING NEUTRON FLUX IN NUCLEAR REACTORS. Brunello Rispoli (Comitato Nazionale Energia Nucleare, [Rome]). Comit. Naz. Energia Nucl., Notiziario, 8: No. 6, 11p.(June 1962). (RT/EL(62)16). (In Italian)

The choice for neutron-flux-measuring instruments in nuclear reactors depends on the type of detectors used and on the reactor's operational stage. A systematic study of γ and neutron flux detectors and related electronic instrumentation needed for reactor control, and for experimental work with reactors and particle accelerators, is presented. A full description is given of instruments, neutron-thermopile-measurement methods, a neutron thermopile design, and experimental results. (auth)

6448 AN IMPROVEMENT OF THE COINCIDENCE METHOD FOR THE ABSOLUTE DETERMINATION OF THE DECAY RATES OF RADIOACTIVE PREPARATIONS. R. Frosch, P. Huber, and F. Widder (Universität, Basel). Helv. Phys. Acta, 35: 304-7(1962). (In German)

In all versions of the coincidence method in which energy-sensitive detectors and pulse analyzers must be used for the calibration of the counting tube efficiency, the pulse causes complications when the two coinciding beams produce one effect in the same detector. The sum pulse has a different spectrum from the individual pulse and the probability that the sum pulse will be counted is not the same as that for the individual pulse. The essential innovation reported is a breakdown of the counting probabilities: W_{ij} as the probability that one of two coinciding radiations would produce an effect in one of two detectors and with V_{ij} as the probability that one effect of radiation j in the detector i would have a pulse which would be counted. The counting rates in the three scales of coincidence apparatus are tabulated. An example is given of a $\gamma-\gamma$ cascade measured using a two-channel pulse analyzer. (J.S.R.)

6449 INVESTIGATION OF THE LIMITS FOR THE MEASUREMENT OF WEAK ACTIVITY. Chr. Gfeller and H. Oeschger (Universität, Bern). Helv. Phys. Acta, 35: 307-13(1962). (In German)

For the measurement of the activity of soft β emitters, proportional counters are generally used with the sample in gaseous form. In order to reduce the background, the counter is surrounded by coincidence circuits and shielded with heavy material. The residual background is investigated using a counter tube developed by Hotermans and Oeschger, its construction being shown schmatically. The dependence of the background on the counter gas pressure or the foil thickness were determined. The measurement results are shown graphically. An approximation formula was used to explain the relations found in the graphic representation of the results. (J.S.R.)

6450 EXCITED STATE LIFETIME MEASUREMENTS USING A PULSED BEAM ACCELERATOR AND COINCIDENCE METHODS. R. E. Pixley, R. Szostak, and B. Gobbi (Eidgenossische Technische Hochschule, Zurich). Helv. Phys. Acta, 35: 323-4(1962). (In English)

An improvement in the centroid shift method for the measurement of excited state lifetimes of less than 200 psec is reported. By the use of a p-n junction silicon detector in slow coincidence with the gamma counter, it is possible to select a charged particle group going to a single level for level spacings of 100 kev or more. The same

target can then be used for both the prompt source and the gamma source being measured, and the two time spectra can be stored simultaneously in different sections of a multi-channel analyzer. It is shown that there is no error in the centroid shift measurement caused by changes in the overall counting rate as long as the coincidence counting rates in the two time spectra are affected similarly. The accuracy of the method is limited by systematic errors. (J.S.R.)

6451 ANTICOINCIDENCE COUNTING METHOD FOR STANDARDIZING RADIOACTIVE MATERIALS. J. Bryant (United Kingdom Atomic Energy Authority, Amersham, Bucks, Eng.). Intern. J. Appl. Radiation Isotopes, 13: 273-6(June 1962). (In English)

The application of anticoincidence counting to the coincidence method of standardizing radioactive materials is discussed. The advantages of simultaneous coincidence and anticoincidence counting in a practical $4\pi\beta$-γ system are described. (auth)

6452 ISOTHERMAL CALORIMETER FOR REACTOR RADIATION DOSIMETRY. B. Radak and V. Marković (Boris Kidric Inst., Vintcha, Yugoslavia). Intern. J. Appl. Radiation Isotopes, 13: 287-93(June 1962). (In English)

An isothermal calorimeter with thermistors for measuring absorbed dose rates from 10^4 to 6×10^5 rad/hr in reactor experimental holes was designed. A kinetic method for determining the equilibrium temperature difference was developed and its application in isothermal calorimetry proved. The expected accuracy in measurements within ±2 to 5 per cent was proved by measurements carried out in the reactor. Some data obtained by measurements in the 5 Mw reactor at Vintcha are presented. (auth)

6453 THE USE OF ION EXCHANGE COLUMNS IN THE MEASUREMENT OF DOSES BELOW 1000 RAD WITH THE FRICKE DOSIMETER. O. S. Gal (Boris Kidric Inst., Vintcha, Yugoslavia). Intern. J. Appl. Radiation Isotopes, 13: 304-6(June 1962). (In English)

The use of Fe^{59} as tracer in the solution of the Fricke dosimeter for low doses is discussed. Solvent extraction as a means of separating the ferric ions from the ferrous ions involves considerable error, and it was found that a zirconium phosphate ion-exchange column simplified the separation. Ferrous ions are eluted with 0.1N H_2SO_4, while ferric ions are retained on the column but may be eluted with 6N HCl. A dosimetric procedure using Fe^{59} and ion-exchange separation is outlined; it was found suitable for measuring doses from 1000 to 40 rad, and the lower limit is 10 to 20 rad. (D.L.C.)

6454 EXTERNAL STANDARD METHOD FOR THE DETERMINATION OF THE EFFICIENCY IN LIQUID SCINTILLATION COUNTING. T. Higashimura, O. Yamada, N. Nohara, and T. Shidei (Kyoto Univ.). Intern. J. Appl. Radiation Isotopes, 13: 308-9(June 1962). (In English)

The use of an external gamma source was investigated to see if the detection of gammas in the C^{14} scintillation counter could be correlated with the efficiency. Cs^{137}, Ce^{144}, and pitchblende were used as gamma sources, and different quenchers were used to vary the efficiency. The plots of C^{14} efficiency vs gamma count rate show that, for a given source, the degree of quenching is independent of the type of quencher used. It is pointed out, however, that the external source offers only secondary standardization as it relies on the internal standard method for the initial correlation curve. (D.L.C.)

6455 ABSOLUTE MEASUREMENT OF THE ACTIVITY OF RADIONUCLIDES BY THE BETA-GAMMA COINCIDENCE METHOD USING DETECTORS OF GREAT EFFICIENCY—DEAD-TIME CORRECTIONS. A. Gandy (Fondation Curie, Paris). Intern. J. Appl. Radiation Isotopes, 13: 501-13(Sept. 1962). (In French)

After a critical study of the different solutions proposed to solve the problem of the dead-time correction, a new solution is presented which does not depend on any approximation and which permits the application of the corrections to any desired degree of accuracy. The experimental study following on this investigation verifies the theoretical conclusions. (auth)

6456 A COMPACT ANTICOINCIDENCE COUNTER FOR TROPICAL CONDITIONS. R. A. Hunt (Univ. of Ghana, Accra). J. Sci. Instr., 39: 604-7(Dec. 1962).

Low-level beta counting equipment is described which was designed for the portable use in tropical conditions. The beta counter is shielded by a hemispherical guard counter and when the whole assembly is mounted into a standard square castle (4·2 cm lead), a background count of 1·35 counts per minute is obtained. Transistors are used throughout the circuit which is operated directly from low voltage supplies. (auth)

6457 A MINIATURE RADIATION MONITOR WITH TRANSISTORS. H. Klessman (Hahn-meitner-Institut für Kernforschung, Berlin). Kerntechnik, 4: 446(Oct. 1962). (In German)

A personnel dosimeter about the size of an ink pin which can be worn at all times and that needs no service was developed. By means of a d-c voltage converter with high efficiency and a monostable tripping circuit with complementary transistors (pnp-npn), a low current consumption of about 0.8 ma and an operating time of about 6 weeks were achieved. The radiation detector is a miniature G-M tube. (M.C.G.)

6458 SIGNAL-TO-NOISE RATIO OF A P-N-JUNCTION RADIATION COUNTER. J. A. W. van der Does de Bye. Philips Res. Rept., 16: 85-95(Feb. 1961). (In English)

With a p-n diode of low capacitance x-ray quanta can be counted. The quanta generate electron-hole pairs in the space-charge layer between the n and p regions of a reversely biased diode. The complete collection of the charge so generated makes radiation spectrometry possible. The signal-to-noise ratio of the p-n counter of this type is discussed. It is found that the spectral line width caused by noise can be reduced to 3 kev and the discriminator can be set at 6 kev to reject most of the noise. These values are calculated for the case of a thermionic amplifier with RC pulse shaping and are determined mainly by the diode current noise, the tube shot noise and the total input capacitance, which together constitute a figure of merit for the p-n counter. The values found experimentally are about 1.5 times higher than this figure. (auth)

6459 THE ABSOLUTE MEASUREMENT OF β-RADIOACTIVITY BY 4π COUNTING USING PLASTIC SCINTILLATORS. T. Radoszewski and N. G. Trott (Royal Cancer Hospital, London). Phys. Med. Biol., 7: 319-28 (Dec. 1962).

A description is given of a simple type 4π β-scintillation counter which consists of a single 13 stage photomultiplier tube and two thin (~1.3 mm thick, 2.5 cm square) plastic scintillators having sources mounted between them, operated at −25°C. The characteristics of the instrument are discussed and results of intercomparisons of measurements of solutions of several radio nuclides by this and a 4π Geiger β-counting technique are reported. It is concluded that the method is satisfactory for the absolute measurement of β-emitters of maximum energy ~0.5 Mev and above,

although the accuracy attained is unlikely to exceed that possible using 4π Geiger and proportional counting techniques. It is noted that the comparative simplicity of the method should prove an advantage where highest accuracy in such measurements is not required. (auth)

6460 A GAMMA RAY DOSEMETER WITH A LONG MEMORY. A. R. Jones (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Med. Biol., 7: 353-8(Dec. 1962).

A dosemeter is described in which the information is in digital form and stored in an electronic scaler. The scaler was designed to draw little power and operate over a wide temperature range. During mains failures the scaler can switch to an internal battery for periods up to one week without affecting the accumulation and storage of information. The digital information was obtained from a Geiger tube which provides a pulse rate proportional to the γ-ray intensity. Steps were taken to minimize the effect of photon energy on the proportionality. (auth)

6461 AN IONIZATION CHAMBER AS A CURRENT REFERENCE STANDARD. L. A. W. Kemp (London Hospital Research Labs.). Phys. Med. Biol., 7: 359-64 (Dec. 1962).

An ionization chamber incorporating a Pm^{147} β-ray source was developed, which provides adjustable reference currents of the order of 10^{-9} amp. A special feature of the chamber is that despite the relatively high value of the reference current the magnitude of the latter is independent of the collector voltage over a considerable range, thus making it possible to use the chamber in conjunction with electrometer systems which do not maintain a constant potential at their inputs. The current is closely proportional to the mass of gas between the chamber electrodes, thus providing automatic correction for pressure and temperature changes when the chamber is used as a monitoring reference standard for a second (unscaled) experimental chamber. (auth)

6462 PROPORTIONAL COUNTER PROTON-RECOIL SPECTROMETER WITH GAMMA DISCRIMINATION. E. F. Bennett (Argonne National Lab., Ill.). Rev. Sci. Instr., 33: 1153-60(Nov. 1962). (TID-16600)

A proton-recoil methane proportional counter was used as a neutron energy spectrometer in the presence of conversion electrons from background gamma rays. A difference in the rise time of the voltage profile for conversion-electron and recoil-proton events of the same total ionization was made the basis for an electronic gamma-neutron discrimination technique. Use of the gamma rejection technique was equivalent to an effective reduction in gamma sensitivity of the detector by a factor of 450. Spectroscopic information on a broad incident neutron spectrum was extended from the region above 350 kev to that above 80 kev. (auth)

6463 VERSATILE BUBBLE-CHAMBER TRACK MEASURING STAGE. Ernest M. Bolze (Brookhaven National Lab., Upton, N. Y.) and Frederick Ayer, II. Rev. Sci. Instr., 33: 1190-5(Nov. 1962).

A measuring stage for bubble chamber film, having some interesting features in both its film transfer mechanism and its stage motor drive, is described. Power for the stage motion is supplied by pairs of motors geared to differentials, the speed of one motor being controllable. Lead screw speed is, therefore, continuously variable in both directions. Measurement of coordinates of points on a track with the assistance of a track centering device is outlined in principle. The film transfer mechanism will accommodate four stereo-views on separate films on any width from 35 to 70 mm and any length from 100-ft spools to 1000 ft, wound on cores, with the maximum ease of convertibility. (auth)

6464 BUBBLE CHAMBER TRACK-CENTERING DEVICE WITH DIGITIZED OUTPUT. Eric Pickup (Brookhaven National Lab., Upton, N. Y.), Edwin F. Rappe, Gaylord Wall, and Frederick Ayer, II. Rev. Sci. Instr., 33: 1196-1200(Nov. 1962).

A means for automatically determining the coordinates of a point, quickly and accurately, at the center of a bubble chamber track is described. A coarse setting of operator-controlled cross hairs, supported by a toolmaker's stage, is made and the distance between the cross hairs and the track center is found by means of a system based on a vibrating slit which scans a portion of the track. The distance is reduced to digital form and printed out on tape along with the coordinates of the coarse stage setting. A computer routine then determines the true position of the point on the track. (auth)

6465 FAST NEUTRON TIME-OF-FLIGHT SPECTROMETER. H. W. Lefevre, R. R. Borchers, and C. H. Poppe (Univ. of Wisconsin, Madison). Rev. Sci. Instr., 33: 1231-4(Nov. 1962). (TID-16525)

A fast neutron time-of-flight spectrometer for use with a tandem accelerator is described. Charged-particle bursts of less than 2-nsec duration and with peak currents of 15 to 20 μA are produced by bunching the negative particle beam before acceleration and chopping the positive particle beam after acceleration. (auth)

6466 IMAGE FORCE VELOCITY SELECTOR FOR CHARGED PARTICLES. Frederick W. Kantor (Integrated Research and Tech., Inc., Bellerose, N. Y.). Rev. Sci. Instr., 33: 1234-5(Nov. 1962).

A velocity selector for charged particles can be made utilizing, exclusively, image forces. The velocity of the emerging particles depends only on machining and fundamental constants. Electron velocities less than 500 m/sec appear feasible. (auth)

6467 A THERMAL NEUTRON FISSION COUNTER FOR NUCLEAR AND ANALYTICAL MEASUREMENTS. James Gray, Jr. and French Hagemann (Argonne National Lab., Ill.). Rev. Sci. Instr., 33: 1258-64(Nov. 1962). (TID-17118)

A fission counter which has been used at the Argonne CP-5 reactor is described. It was applied to the measurement of thermal neutron fission cross sections and to the determination of very small quantities of fissionable materials. The counting system consists of a dual chamber fission counter, the associated electronic apparatus, a mechanism for positioning the counter in the thermal column, and the protective neutron shielding. The design and performance of the system and the operating procedures are discussed in detail. (auth)

6468 OBSERVATION OF PHOTOMULTIPLIER PULSES WITH A SAMPLING OSCILLOSCOPE. Martin Feldman (Cornell Univ., Ithaca, N. Y.). Rev. Sci. Instr., 33: 1283(Nov. 1962).

A circuit used to observe photomultiplier pulses with a sampling oscilloscope, is described. The circuit is a window discriminator which gates the oscilloscope unblanking pulse, and only a narrow range of photomultiplier pulse heights is allowed to fire the blocking oscillator. (D.L.C.)

6469 PHOTOGRAPHIC METHOD OF CODING COUNTER PULSES. Albert L. Whetstone (Univ. of Pennsylvania, Philadelphia). Rev. Sci. Instr., 33: 1284-6(Nov. 1962).

An electroluminescent panel with 50 elements was mounted on an oscilloscope in order to identify which phototube of a counter array produced the pulse on an oscilloscope photograph. The driving circuit is described. The panel can also be used to record other information about the event on the photograph. (D.L.C.)

6470 GAS-FLOW COUNTING OF CARBON-14 COMPOUNDS: AN IMPROVED TECHNIQUE. Harold J. Perkins and M. C. MacDonald (Canada Agriculture Research Station, Lethbridge, Alberta). Science, 138: 1259-60(Dec. 14, 1962).

Reproducibility in counting by a gas-flow detector of duplicate samples of C^{14}-labeled compounds plated on glass planchets is much improved by spraying of the lower surface of the planchet with an "antistatic" agent in aerosol form. Count rates that decreased with time were eliminated by this treatment. (auth)

6471 UNIVERSAL CONDENSER DOSIMETER FOR X-RAY AND γ RADIATION. A. N. Krongauz, I. M. Parshin, V. R. Broksh, Yu. D. Gromov, and V. N. Yakunin (State Inst. of Scientific Research in Roentgen-Radiology, USSR). Vestn. Rentgenol. i Radiol., 37: No. 5, 60-3(Sept.-Oct. 1962). (In Russian)

Descriptions are given of the design and performance of an improved condenser dosimeter capable of measuring up to 1500 r per min of varifying γ- and x-ray doses in therapeutic apparatus. A 0.7 cm^3 spherical perylene ionization chamber was used for measuring soft, high-energy, geometrically heterogeneous x-ray beams. The chamber is capable of measuring up to 2500 or 10000 r per min. Measurements of 600 to 2000 r are made with the ionization chamber covered by aluminum hoods. (R.V.J.)

6472 ON THE SENSITIVITY OF LIQUIDS TO IRRADIATION. Yu. A. Aleksandrov, G. S. Voronov, and N. B. Delone (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1552-4(Oct. 1962). (In Russian)

It was previously shown that vapor bubbles are formed along charged particle tracks at certain temperatures. Experiments were conducted to analyze the sensitivity of a liquid to charged particles during a fast drop in pressure. The pressure in a propane filled bubble chamber at 68°C was decreased within 2 μsec from 34 to 13 to 19 atm during Co^{60} γ irradiation. The results showed that vapor bubbles are initiated by irradiation in unheated liquid and grow to a size that can be observed ($\sim 10^{-2}$ cm). The sensitivity (number of bubbles in a unit volume and track density) is determined by the pressure drop rate and the absolute pressure. The sensitivity is enhanced at higher dP/dt. Observations were made at dP/dt from 0.3 to 2.0 atm/sec. (R.V.J.)

6473 APPLICATIONS OF SCINTILLATION SPECTROMETRY TO RESEARCH REACTOR FUEL ASSAY. Ronald B. Perry (Argonne National Lab., Ill.). Aug. 28, 1962. Contract [W-31-109-eng-38]. 20p. (UAC-6838; ANL-FGF-382)

To be published in TID-7642, Proceedings of the Conference on Research Reactor Fuel Elements, held in Gatlinburg, Tenn., Sept. 17-19, 1962.

Procedures for quantitative measurement of U^{235} content in reactor fuels based on emission of 184 kev gamma radiation are presented. A single channel scintillation spectrometer with a NaI(Tl) crystal detector is used. Data obtained in scintillation spectrometry of individual fuel plates are given along with results for an entire reactor loading. Graphic data presentations and equipment photographs are included. (J.R.D.)

6474 MEASUREMENT OF NEUTRON DENSITIES BY ACTIVATION OF NaI (Tl) CRYSTALS. B. Grimeland (Univ. of Oslo), E. Kjellsby, K. Bryhn-Ingebrigsten, and C. van Dijk. IAEA Preprint SM-36/1. 14p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Crystals of NaI (Tl) weighing from 0.1 to a few grams are irradiated in the neutron field, and activities due to the disintegration of Na^{24} (half life 15.06 h) and I^{128} (half life 25.0 m) are induced. The crystals are placed on the top of a photomultiplier tube and the activities measured. 4π geometry is obtained since the active material is situated inside the scintillator. The absolute disintegration rate is determined from extrapolation of measured bias curves. A great number of measurements have been made in which two or more crystals were irradiated simultaneously. The same specific activity was obtained within an accuracy of about 3%. A comparison has also been made with the coincidence method and the agreement was quite good. Sodium is an almost pure "one over v" absorber and is very well suited for neutron density measurements. The activation cross section is only 0.53 barns, but it is estimated that densities as small as 0.05 n/cm^3 can be measured. Iodine has an activation cross section of 5.6 barns, but owing to its many resonances it is not so well suited for density measurements. The iodine activity may however be used for rough measurements of very small densities. Most of the absolute neutron density measurements in the JEEP were carried out by this method. Furthermore, it is the only method which has been used so far for absolute density measurements in HBWR (Halden Boiling Water Reactor) and in NORA (the new zero power reactor at Kjeller). Experience has shown that the method is simple, reliable, and fairly accurate. Besides this it does not require any apparatus that would not be present anyway at any nuclear laboratory. (auth)

6475 ROTATING RIG FOR DOSIMETER CALIBRATION. J. Thomas, A. Jensen, S. A. Moerk, and J. Ovist (Forsøgsanlaeg Risø, Roskilde, Denmark). IAEA Preprint SM-36/22. 6p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A short description of a rotating rig for evaluating the influence of the self-shielding in dosimeter materials is given. The rig is inserted in a 4-in. vertical experimental facility in DR3, a Pluto type reactor. (auth)

6476 AN AUTOMATIC SCANNER FOR NUCLEAR EMULSIONS. A. Narath and P. Koeppe (Technische Universität, Berlin). IAEA Preprint Sm-36/27. 11p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

The scanner uses a normal microscope which can be switched to visual inspection at any time. The counting of the tracks in the emulsion is independent of their direction in the microscope plane. The minimum length of the tracks counted to date is equivalent to some 3 to 5 grains. Fog grains are suppressed by a threefold coincidence, and impurities in the emulsion, such as silver clusters or scrapers, are suppressed by an anticoincidence circuit. Provision has been made for using a point plotter for automatic and magnified plotting of tracks. An experimental model built for scanning of emulsion on glass plates has in principle been proved successful. For routine use the stability of both the electronics and the movement of the motor-driven microscope stage has to be improved. (auth)

6477 ENERGY DEPENDENCE OF PROPORTIONAL COUNTER FAST NEUTRON DOSIMETERS. R. S. Caswell, W. B. Beverly and V. Spiegel, Jr. (National Bureau of Standards, Washington, D. C.). IAEA Preprint SM-36/63. 20p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A proportional counter dosimeter with polyethylene walls and ethylene gas filling is widely used for neutron dosimetry in the presence of gamma rays. Large pulses due to recoils from neutrons are accepted and pulse-height integrated; small pulses due to secondary electrons from gamma rays are rejected. Since this instrument approximates a Bragg-Gray cavity with identical walls and gas, it should correctly measure "first collision" dose for neutrons, independent of cavity size. A correction, however, must be made for the loss of small pulses due to neutron recoils which are below the "bias," the pulse-height level below which all pulses are rejected in order to achieve gamma-ray discrimination. Hurst has suggested that a factor $1 - (B/E)^2$ be used to correct for the effect of the bias, where B is the bias energy and E is the incident neutron energy. It should therefore be possible to take theoretical curves for first collision dose, apply a correction for the bias used to them, and obtain, from theory only, the response of the dosimeter. Measurements were made of the response of a dosimeter similar to the "phantom" dosimeter described by Hurst to measured fluxes of monoenergetic neutrons of energies 0.1 Mev (the bias energy used), 0.2 Mev, 0.3 Mev, 0.6 Mev, 0.9 Mev, 2.56 Mev, and 4.0 Mev from a Van de Graaff accelerator. It was found that the response of the dosimeter deviates markedly from the theoretical response, especially at low energies near the bias energy. For accurate neutron dosimetry it appears that it is not sufficient to assume that the theoretical relation is valid, but the response of the dosimeter should be empirically measured. Data were taken on a 256-channel pulse-height analyzer and numerically integrated. Pulse-height distributions for neutrons of various energies are shown. The pulse-height distributions show a peak due to particles of minimum ionization crossing the cavity, indicating that the resolution of the counter is satisfactory. Possible causes of the discrepancy between experiment and theory are discussed. It appears that, at the present state of the art, energy response for this type of dosimeter should be experimentally determined for accurate neutron dosimetry. (auth)

6478 A DETECTOR FOR INTERMEDIATE ENERGY NEUTRONS. J. K. Basson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IAEA Preprint SM-36/38. 16p. (AERE-R-3864) (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

An intermediate-energy neutron detector has been developed, consisting of a small wax sphere surrounding a boron-loaded scintillation counter. The energy dependence of the detector was tested using the Harwell "neutron booster," which provides short pulses of neutrons whose energies may be measured by time-of-flight techniques. With the optimum size of 6.3 cm diameter, the response was proportional to within ±12% of the neutron dose rate in the energy range 1 ev to 10 kev. This size would be suitable for use in a portable survey monitor. (auth)

6479 A TWIN ION CHAMBER SYSTEM FOR CONTINUOUS MONITORING OF DOSE AND DOSE-RATE FROM MIXED NEUTRON AND GAMMA RADIATIONS. W. Abson and R. P. Henderson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IAEA Preprint SM-36/49. 14p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Design details and radiation characteristics of a high-pressure hydrogen-filled chamber are given. The ionization current per unit neutron flux in the energy range 0.1 to 10 Mev varies inversely with recommended maximum permissible flux levels over this energy range, and the chamber response can be regarded as being proportional to the maximum r.e.m. dose in the body within an accuracy of ±30%. The gamma sensitivity (i.e., response per r.e.m. due to gamma radiation) does not correspond to the neutron sensitivity but this can be corrected by the use of second chamber. Chamber 1 (high pressure hydrogen + small proportion of argon) is connected in opposition to chamber 2 (neon + argon). Chamber 2 has a very low neutron sensitivity and its gamma sensitivity is adjusted so that the resultant gamma sensitivity of the pair is equal to the neutron sensitivity. The gamma energy characteristics of each chamber match closely over a wide energy range. (auth)

6480 INTERCOMPARISON OF FAST NEUTRON DOSIMETRY. A. L. Batchelor (Medical Research Council, Harwell, Berks, Eng.). IAEA Preprint SM-36/51. 12p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

In August 1960 the Biophysics Section of the Medical Research Council Radiobiological Research Unit (RRU), Harwell, made some more intercomparisons of its ionization chamber method of measuring fast neutron dose with other methods used in the United States. The fast neutron dose measuring equipment used by RRU for these intercomparisons was transported to the United States Radiological Defense Laboratory (NRDL) at San Francisco and Los Alamos Scientific Laboratory (LASL) at University of California. At NRDL the 60-in. Berkeley cyclotron was used to provide a source of neutrons for the intercomparison, and the neutron spectrum was similar to that obtained from slow neutron fission of uranium. The NRDL method of dosimetry depended on knowing the neutron spectrum and determining the neutron flux during an exposure by measurements of the activation induced in small sulfur disks. It was found that the ratio RRU Measured Neutron Dose/NRDL Measured Dose, was 0.94. The Godiva II Critical Assembly was used to provide a continuous source of neutrons for the intercomparisons at LASL, and the intercomparison was made indirectly with a tissue-equivalent ionization chamber. It was found that the ratio RRU Measured Neutron Dose/LASL Measured Neutron Dose was 1.09. (auth)

6481 A He^3-FILLED SEMICONDUCTOR COUNTER FOR THE MEASUREMENT OF FAST NEUTRON SPECTRA. M. E. Lee and M. L. Awcock (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IAEA Preprint SM-36/55. 16p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

The counter employs two silicon surface-barrier diodes to detect the proton and triton from the $He^3(n,p)$ reaction. The signals from each diode are summed to give the total

energy of the reaction products and hence the neutron energy. A coincidence counting technique is used to eliminate single pulses, occurring in either of the two diodes, produced by He^3 recoils and (n,p) or (n,a) reactions in the silicon. The diodes each have a sensitive area of 2.8 cm^2 and are mounted with their front surfaces 0.7 mm apart. The pressure of the He^3 is 3 atmospheres, giving a detection efficiency of 10^{-5} for 3-Mev neutrons. Results of experiments with thermal neutrons and mono-energetic neutrons in the range 3 to 7 Mev are described. (auth)

6482 SOME INVESTIGATIONS OF THE INTERMEDIATE-ENERGY NEUTRON SPECTRA AROUND NUCLEAR INSTALLATIONS. J. W. Smith (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IAEA Preprint SM-36/59. 10p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Investigations using the Basson intermediate-energy neutron detector, cadmium-covered BF_3 counters, boron-covered fission detectors, and activated-foil techniques have been used to investigate the intermediate-energy neutron spectra in the neighborhood of nuclear reactors, neutron-generating machines, and neutron sources. These measurements were related to others made of the fast and thermal neutron fluxes. (auth)

6483 FAST FLUX MEASUREMENTS IN ZERO ENERGY REACTORS. R. J. Trebilcock (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IAEA Preprint SM-36/60. 11p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A number of high-power research reactors have zero-energy counterparts, and it is desirable to use these as far as possible for flux measurements on experimental rigs. Measurement of fast flux in high-power reactors may be accomplished using threshold detectors such as S^{32} or Ni^{58}, but these are sufficiently sensitive for measurements near the core in zero-energy reactors, where the large samples necessary would cause severe flux perturbation. The use of Rh^{103} and P^{32} for fast flux measurements is described, and comparisons are given which enable sulfur and nickel activations to be predicted from measurements with phosphorus and rhodium. An appendix gives experimental details on the use of rhodium and phosphorus. (auth)

6484 THERMAL NEUTRON FLUX PERTURBATION IN DIFFUSING MEDIA. E. D. Klema (Northwestern Univ., Evanston, Ill.). IAEA Preprint SM-36/75. 8p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Recently a considerable amount of work has been done on the problem of the determination of the perturbation of a thermal neutron flux in a diffusing medium produced by the insertion of a foil or wire detector to measure the flux. The calculation of the effect has been improved by new methods using high-speed digital computers, and a number of experiments have been performed to measure the effect with greater accuracy than has been achieved previously. In addition, detailed consideration has been given to the problem of the correct method to be used in comparing theory and experiment. The results of these investigations are summarized, and the present state of the problem and the areas in which work appears to be most urgently needed at present are indicated. (auth)

6485 NEUTRON THERMOPILES FOR FLUX MEASUREMENT IN NUCLEAR REACTORS. R. Cervellati, R. Gislon, and B. Rispoli (Centro di Studi Nucleari della Casaccia, Rome). IAEA Preprint SM-36/96. 8p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A thermopile has been constructed having boron heads on the junctions of thin thermoelectric wires because this type gives the cylindrical symmetry required by the reactor and permits the sensitivity required for an easy reading. The shape and the size of the device have been studied so to allow the scanning throughout the core, entering the 8-mm-diam. holes of the plates supporting the fuel elements. For the junction boron coating methods different from the ones described in the literature have been used. An attempt was made to use calculations as far as possible for the optimization of the device. In order to calculate the power produced in the boron heads, considerations of flux perturbation and self-shielding which have been developed for foil detectors and absorbing control rods were taken into account. The flux depression caused by the detector was examined, with the aim of minimizing and evaluating it. Measurements were made to determine the temperature reached by the hot junction during the work. (auth)

6486 IMPROVEMENTS IN OR RELATING TO NUCLEAR RADIATION DETECTOR SHIELDING. George Donald Smith (to Plessey Co. Ltd.). British Patent 912,204. Dec. 5, 1962. Filed June 17, 1958.

A radiation detection unit is provided with castle shielding consisting of lid, sleeve, radiation detector tube mounting, and base sections. The positions of the radiation detector tube mounting and sleeve sections may be interchanged relative to the base. (R.J.S.)

6487 IMPROVEMENTS IN PHOTOGRAPHIC SENSITIVE MATERIALS FOR RADIATION MONITORING. (to Kodak Ltd.). British Patent 912,277. Dec. 5, 1962. Filed Feb. 27, 1958.

A photographic-sensitive material is provided comprising a support bearing a number of non-color forming non-optically sensitized silver halide emulsions. The emulsions are sensitive to high energy radiation and are of different speeds. The emulsions are coated so that there is at least one emulsion on each side of the support. The ratio of the speeds of the slowest to fastest emulsion is at least 1 to 10. (R.J.S.)

6488 IMPROVEMENTS IN CONDENSATION NUCLEI DETECTOR. John Edward Bigelow, Frank William Van Luik, Jr., Stuart Burton Dunham, and Theodore Alfred Rich (to General Electric Co.). British Patent 913,400. Dec. 19, 1962. Filed May 23, 1961.

A chamber is described for holding nuclei-containing gas samples with means for expanding the gas samples to produce droplet clouds in the chamber about any nuclei in the samples. Radiant energy means produces electrical signals as a measure of the nuclei present in the samples. (R.J.S.)

6489 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Ronald Hugh Campbell (to United Kingdom Atomic Energy Authority). British Patent 913,489. Dec. 19, 1962. Filed June 12, 1959.

A method of nuclear reactor neutron flux scanning in-

volves introduction of a filament of fluid into a passage traversing the reactor core so that the filament becomes irradiated. Distribution of activity along the filament is measured after removal of the filament from the core. (R.J.S.)

6490 IMPROVEMENTS IN HIGH EXPANSION RATIO CONDENSATION NUCLEI APPARATUS. George Frank Skala (to General Electric Co.). British Patent 913,515. Dec. 19, 1962. Filed May 23, 1961.

Nuclei-bearing and nuclei-free gas samples are alternately valved into the chamber of a condensation nuclei detector. The samples are expanded and means are provided for indicating the intensity of radiation scattered by the resulting fog. Pressure regulators provide a pressure reduction within the chamber of a magnitude just less than that necessary to produce a spontaneous condensation. (R.J.S.)

6491 SCINTILLATOR COMPONENT. Roland W. Carlson (to Harshaw Chemical Co.). U. S. Patent 3,068,359. "Application date Apr. 2, 1959."

A scintillation crystal of thallium activated sodium iodide has been improved by applying a reflective coating over the entire crystal surface with the exception of those areas in direct contact with the end window of a photomultiplier tube. The preferred reflective coating material is dry magnesium oxide or dry aluminum oxide. (R.J.S.)

ISOTOPE SEPARATION

6492 (CEA-tr-A-1161) PROCÉDÉ DE SÉPARATION D'ISOTOPES. (Process for Separation of Isotopes). H. Henker. Translated into French by R. Carbonnier from German Patent No. 1,083,788. Dec. 1955. 6p..

A method based on zone fusion is proposed for the separation of isotopes. The method is particularly adaptable to the production of heavy water. Other elements and compounds which are suitable for processing in this manner for isotope separation are tabulated. (J.S.R.)

6493 GAS CHROMATOGRAPHIC SEPARATION OF HYDROGEN ISOTOPES AND NUCLEAR SPIN ISOMERS. T. Kwan (Tokyo Univ.). Kagaku No Kogyo (Osaka), 14: 723-8(July 1961). (In Japanese)

Separation of hydrogen isotopes and nuclear spin isomers by gas chromatography is discussed by comparing the adsorption equilibrium coefficient with the liquid–vapor equilibrium coefficient. The relation of the separation factor to the retention time in the chromatographic process is pointed out. The separation factors calculated on the basis of the retention times are tabulated. A model of the rotation of the molecule on the solid surface is presented and related to the separation factor. The history of the separation of the peaks of $p-H_2$, $o-H_2$; $p-D_2$, $o-D_2$ or $HD-D_2$, and $p-H_2$, $o-H_2$, HD, D_2 is reviewed, describing the methods used for preparing pure H_2 not including HD, together with concentration processes of D_2 and preparation methods of $p-H_2$ and $o-H_2$. (TTT)

MATHEMATICS AND COMPUTERS

Refer also to abstracts 7345 and 7346.

6494 (ANL-6628) AUTOMATIC FOIL ACTIVITY COUNTING FACILITY AND DATA-REDUCTION PROGRAM. K. E. Plumlee and M. T. Wiggins (Argonne National Lab., Ill.). Oct. 1962. Contract W-31-109-eng-38. 43p.

A transistorized automatic counting and recording system was built for the determination of foil-activation data. Output data are on IBM-printed and punched cards which may be processed by a high-speed computer. The computer produces tabular and graphical output, as well as punched data cards which may be used for further processing such as curve fitting. The foil-activation data are taken from one to six chains operating in unison (normally sample-changer, detector, amplifier, analyzer, scaler, and read-out chains). Circuitry and logic of the system were greatly simplified by the use of a one-second interval marker which initiates and terminates each step of the cycle in full seconds rather than fractional seconds. The equipment includes provision for optional preset counting interval or preset count accumulation. There are sensing devices to record the kind of measurement made (whether foil activation or background count), plus manual switches which may also specify how individual measurements will be processed later by the computer, on a card-by-card and scaler-by-scaler basis. Data are processed by an IBM-704 computer programmed to produce plotted traverses as well as tabular data. From 25 to 100 foil-activation measurements per minute may be processed, depending on the number of entries per card and the use of preprocessing equipment. The data reduction includes many repetitive steps which the computer does very precisely and economically. (auth)

6495 (CNEN-140) POLLY. ONE GROUP FERMI AGE, THREE CORES RADIALLY REFLECTED CYLINDRICAL REACTOR DESIGN CODE FOR IBM-650. P. Azzoni, F. Casali, and F. Pierantoni (Italy. Comitato Nazionale per l'Energia Nucleare. Centro di Calcolo, Bologna). Dec. 1961. 32p.

The option of the Polly R code includes the choice of the eigenvalues R, B_i^2, and B_a^2 = (i = 1, 2, 3), where R_i = external radius of i-th core, B_i^2 = buckling of i-th core, and B_a^2 = axial buckling. The calculation of the radial flux is given by Polly T code. (J.R.D.)

6496 (HW-SA-2552) APPLICATIONS OF ANALOG COMPUTERS IN NUCLEAR PROCESSES. W. D. Cameron and G. R. Taylor (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 24, 1962. Contract AT(45-1)-1350. 48p.

The various methods used in simulating atomic reactors and processes, particularly the types used at the Hanford plant, are outlined and explained. The newer as well as standard techniques used in reactor simulation are described. The applications are described by examples. The techniques used in a complete atomic reactor plant simulator are described. Chemical processing simulations are discussed using specific examples. (auth)

6497 (NP-12304) CORRECTIONS TO THE GOLDSTONE EXPANSION. Amnon Katz (Harvard Univ., Cambridge, Mass. Lyman Lab. [of Physics]). [1960]. 14p.

A perturbation expansion of $-\lim_{\beta\to\infty}\frac{1}{\beta}\log(F|e^{-\beta H}|F)$ results in the Goldstone series. A perturbation expansion of $-\lim_{\beta\to\infty}\frac{1}{\beta}\log \mathrm{Tr}e^{-\beta H}$ may contain corrections to that series. These corrections are discussed for a system of finite volume. It was found that: no corrections are obtained unless a class of diagrams is summed before application of the limit $\beta\to\infty$; the corrections of Luttinger and Ward and of Balian, Bloch, and De Dominicis result from presummation of single particle self energies and spirals; and if larger classes of diagrams are presummed, further corrections result. (auth)

6498 (NP-12307) PRELIMINARY DESCRIPTION OF THE TRANSFER MEMORY. Sylvian R. Ray (Illinois. Univ., Urbana. Digital Computer Lab.). Aug. 23, 1962. 13p.

The transfer memory (TM) of the Pattern Articulation Unit is a 32 × 1024 bit store which acts as a buffer for the stalactite array. The stored words may be considered to lie either horizontally or vertically. The registers seen by the programmer, organization and sequencing of the TM, general design considerations, experimental status, and component requirements are discussed. (M.C.G.)

6499 (NP-12308) OBSERVATIONS OF THE OPERATION OF A 3-BIT BUBBLING REGISTER. K. C. Smith and Dennis Hall (Illinois. Univ., Urbana. Digital Computer Lab.). Aug. 31, 1962. 15p.

The operation of a particular circuit which exhibits the properties of bubble gating logic is demonstrated. A "brute-force flipflop" is used to illustrate various effects. Pictures of the model operation are shown. (M.C.G.)

6500 (SCTM-144-62(24)) A METHOD OF TIMING THE OPERATIONS OF A DIGITAL COMPUTING SYSTEM. Gerard W. Hauer, Jr. (Sandia Corp., Albuquerque, N. Mex.). July 1962. Contract [AT(29-1)-789]. 9p.

One method of timing the writing onto and the reading from a drum-type memory system in which the recirculating registers are tracks on the drum is discussed. The input and output operations require certain exchanges of information by means of timing signals. The computer tells the input or output device to start, and the input or output device tells the computer when it has finished. The physical separation between the read and write heads on the recirculating tracks also influences the timing of the computer operations. (auth)

6501 (TID-14155) A TERNARY MEMORY ELEMENT USING A TUNNEL DIODE. Forrest Salter (Argonne National Lab., Ill.). Nov. 28, 1960. Contract W-31-109-eng-38. 5p. (UAC-4779)

A ternary computer using a tunnel diode is described and evaluated. The characteristic current-voltage curve of the tunnel diode is shown. Advantages of the three-state memory are listed as: low number of components in the memory, unnecessary to clear before transfer, less hardware, lower costs, and lower power consumption. (M.C.G.)

6502 (TID-14532) AN EXTRAPOLATION PROCEDURE FOR SOLVING LINEAR SYSTEMS. Thomas A. Oliphant (Los Alamos Scientific Lab., N. Mex.). [1960]. Contract [W-7405-eng-36]. 15p. (LADC-5134)

The solution of linear partial differential equations such as $\nabla\cdot\{f(\vec{r})\nabla\Theta\}+\lambda(\vec{r})\Theta+S(\vec{r})=0$ in two dimensions by approximation of the second partial derivative by a five-point difference scheme is described. Use was made of matrix factorization in setting up iterative procedures for

solving the resulting set of simultaneous linear equations. The successive relaxation method using extrapolative techniques was developed. (M.C.G.)

6503 (TID-14920) THE APPROACH TO STEADY STATE OF SOLUTIONS OF EXTERIOR BOUNDARY VALUE PROBLEMS FOR THE WAVE EQUATION. Robert N. Buchal (Argonne National Lab., Ill.). Dec. 1961. Contract [W-31-109-eng-38]. 13p. (UAC-5894)

It is noted that in any experiment aimed at solving diffraction problems for wave equations, transients induced by turning on the apparatus must die out so that the solution to the steady-state problem represents the steady-state condition of the apparatus. It is proved that the transients at any fixed point decay in time at least as fast as $t^{-\frac{1}{2}}$. (J.R.D.)

6504 (TID-15527) ALGOL 60, AN ALGEBRAIC COMMON LANGUAGE. Henry C. Thacher, Jr. (Argonne National Lab., Ill.). Feb. 26, 1962. Contract [W-31-109-eng-38]. 7p. (UAC-6165)

The procedure-oriented algorithmic language, Algol 60, developed without regard to any computer, is described. The ability of Algol 60 to describe recursive processes is discussed. The generality of the language, the metalinguistic formulas used to define its syntax, translator development, and the use of Algol for communicating among people are also discussed. (M.C.G.)

6505 (TID-17315) VERTICAL VELOCITY COMPUTER DATA SMOOTHING POSSIBILITIES. Sidney Darlington (Bell Telephone Lab., Inc., Murray Hill, N. J.). Mar. 31, 1950. Contract [AT(30-1)-789]. 33p. (SCDC-2952)

Principles and methods which apply to the analysis and design of data smoothing circuits are explained. The frequency concept, error spectra, and network frequency functions are discussed. Probable spectra of instrumental errors are described. The method of resistance-capacity smoothing is outlined. Approach to a theoretical optimum, weighted sums, sensitivity to worst frequencies, and settling time are discussed. Different circuit configurations for the smoothing functions are described. (M.C.G.)

6506 (TID-17350) DESIGN OF CIRCUITS FOR THE PATTERN ARTICULATION UNIT. Report No. 127. K. C. Smith (Illinois. Univ., Urbana. Digital Computer Lab.). Aug. 31, 1962. Contract [AT(11-1)-235]. 44p.

The Pattern Articulation Unit embodies a central core of 1024 identical processing modules called "stalactites" arranged in a two-dimensional array with only local connectivity. Two possible complete circuit realizations of the stalactite are described. Stalactites of either design contain about 50 transistors, 250 diodes, 250 resistors, and 50 capacitors. Stalactite organization, signal flow, the bubbling register connection, the requirements of a working register, design of stacking logic, mode of operation, circuit design, direct and conditional input, design of bubbling logic, complement circuits, output and circuit, up and down drivers, and cable drivers and terminators are described. Experimental verification of various components is discussed. (M.C.G.)

6507 A DIGITAL COMPUTER PROGRAM FOR THE GENERAL AXIALLY SYMMETRIC THIN-SHELL PROBLEM. W. K. Sepetoski, C. E. Pearson, I. W. Dingwell, and A. W. Adkins (Arthur D. Little, Inc., Cambridge, Mass.). J. Appl. Mech., 29: 655-61(Dec. 1962).

The development of a general computer program to handle arbitrary thin shells of revolution subject to radially symmetric loading or temperature variation is described. An elimination method is used to solve the set of difference equations obtained from the basic differential equations; a feature of the method is that "edge effect" difficulties that can arise with conventional differential-equation routines are avoided. The program is quite flexible and permits discontinuities in shell geometry or loading. The results of applying the program to several problems of known solution are given. These results permit the examination of computational accuracy for varying boundary conditions and mesh sizes. Program solutions of unconventional problems are also presented. (auth)

6508 A NEW FORMALISM IN PERTURBATION THEORY USING CONTINUED FRACTIONS. Richard Bellman and John M. Richardson (Rand Corp., Santa Monica, Calif. and Hughes Research Labs., Malibu, Calif.). Proc. Natl. Acad. Sci. U. S., 48: 1913-15(Nov. 15, 1962).

A new approach to problems such as $u = f + \lambda T(u)$ using the classical technique of continued fractions is presented. (P.C.H.)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

Refer also to abstracts 6201, 6473, 7547, 7565, and 7572.

6509 (ARF-1213-5) NONDESTRUCTIVE METHODS OF EVALUATING COATING-METAL BONDS. Second Quarterly Report. A. M. Baumanis and W. E. Lawrie (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Oct. 15, 1962. Contract AF 33(657)-8938. 29p.

Progress in the development of ultrasonic methods to examine the strength and continuity of ceramic-metal bonds is reported. Further work was carried out on the measurement of Rayleigh wave attenuation and on the interferometric method of determining the properties of a coated specimens. Non-ultrasonic methods being studied for possible use in evaluating coating-metal bonds include thermal, electric, and nuclear techniques. (M.C.G.)

6510 (ASD-TDR-62-934) ADVANCEMENT OF HIGH TEMPERATURE PROTECTIVE COATINGS FOR COLUMBIUM ALLOYS. J. D. Gadd and R. A. Jefferys (Thompson Ramo Wooldridge Inc., Cleveland). Oct. 1962. Contract AF33(657)-7396. 111p.

The objective of this program was to improve and simplify the vacuum pack deposition process for forming the protective Cr–Ti–Si diffusion alloy coating on Nb alloys. Halide activation of the process resulted in significant reductions in the time, temperature, and vacuum requirements for the coating process. Process scale up potential was demonstrated by deposition of the Cr–Ti–Si coating at several system pressures up to 150 mm. Conversion of the pack process to a completely vapor deposition process was investigated by closed retort and gas flow techniques. An evaluation of the Cr–Ti–Si coating was conducted on six alloys. (R.J.S.)

6511 (BMI-1593(Del.)) PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING AUGUST, 1962. Russell W. Dayton and Ronald F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Sept. 1, 1962. Contract W-7405-eng-92. Contract [W-7405-eng-92]. 68p.

In Na environment friction and wear tests, self-welding experiments between stainless steel specimens were conducted at 800°F without Na. Breakaway friction coefficients were found to be 2.3 and 0.9 and kinetic friction coefficients after breakaway were 1.25 and 0.9. Other programs in progress include irradiation of 347 stainless steel and burnup of boron compounds. In fuels research, thermal-conductivity measurements of $(ThgU)C_2$, (ThgU)C and $(ThgU)B_4$ were completed. Data on these compounds are tabulated. Data are also given on the physical properties of iron-base Pu alloys for spike fuel applications. In a program to establish understanding of fission-product release in refractory fuels, data were obtained on several fission gases released from UO_2 during irradiation. Other continuing programs are reported on radiation stability of UC, high burnup in homogeneous ceramic reactor fuels, and bonding of ceramic fuel elements. A program to determine the feasibility of using in-process isotope neutron sources to produce short-lived tracers for stream analysis is described. Data on neutron activation applications are included. Data obtained in graft polymerization studies of polymethylmethacrylate and vinyl pyrrolidine are given. In research on radioinduced enhanced catalytic activity, catalysts containing up to 65 mc/g of fission-product beta activity were used in the dehydration of cyclohexanol. Continued work on evaluation of stresses on sealed radiation sources is reported. Data are included on creep-rupture of cold worked Zircaloy-2 at 550, 650, and 750°F. Data are also included on metal-oxide coatings for fuel particles. Data and information on coating of fuel particles with pyrolytic carbon are given along with data on fission-gas release from coated-particle fuels and data obtained in post irradiation studies of these fuels. Progress is also reported in radiation damage in ceramics, fission gas diffusion, fuel compatibility, coolant-compatability, fuel particle thermal conductivity, and strain in ceramics caused by fission fragments. Corrosion studies on candidate materials for fluoride-volatility processes are reported. Data are included on creep-rupture of SAP alloys at 700, 800, and 900°F. Research on fission product deposition, radiation effects, fabrication of UO_2-ZrO_2 systems, properties of irradiated Hastelloy X, properties of Nb alloys, and on methods of joining metal diaphragms is given. (J.R.D.)

6512 (CRRM-1111) PLUTONIUM FUEL PROGRAM IN CANADA. O. J. C. Runnalls (Atomic Energy of Canada Ltd., Chalk River, Ont.). Sept. 1962. 31p. (AECL-1620)

Canadian interest in plutonium is centered on its utilization in thermal reactors. Two possible fuel systems have been studied, Al–Pu alloys and PuO_2-UO_2 ceramics. Both fuel types are easily fabricated and have proved to be stable under a wide range of power reactor environmental conditions. Several recent results from Chalk River irradiation tests on Al–Pu alloys and PuO_2-UO_2 ceramics are cited and supporting out-reactor studies are described. (auth)

6513 (GEAP-4069) POWER CYCLING OF HIGH POWER DENSITY FUEL SPECIMENS CLAD WITH 10-MIL WALL STAINLESS STEEL. T. C. Rowland and J. S. Atkinson (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Oct. 1962. Contract AT (04-3)-361. 37p.

Three thin-wall stainless steel fuel specimens made using fabrication processes and materials similar to the Consumers Big Rock Plant research and development fuel rods were power cycled 3000 times between 500,000 and 75,000 Btu/hr-ft^2 in the General Electric Test Reactor (GETR) Trail Cable facility. The fuel specimens were exposed to 1000 psi boiling water. All of the fuel specimens withstood the test without failing or without any significant changes in the clad characteristics. (auth)

6514 (HW-74784) THE ELECTROLYTIC GROWTH OF DENSE SELF SUPPORTED URANIUM DIOXIDE SHAPES. Final Status Report. F. A. Scott (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 5, 1962. Contract AT(45-1)-1350. 33p.

Polycrystalline cylinders of UO_2 greater than ½ in. diam. and 3 in. long were grown by electrodeposition from molten chloride salt solutions of uranyl chloride onto ¼- and ⅛-in. diam. graphite electrodes. The product had densities up to 99% of theoretical and was composed of radially oriented columnar grains, quite free of voids. The purity was good; the melt components (LiCl and KCl) were present to the extent of less than 50 ppm Li ard K, and as low as 200 ppm chloride. Investigation of two of the process parameters revealed that the density and purity of the UO_2 product im-

prove with increasing deposition temperature and decreasing applied potential. The results of the study indicated that by the proper control of these and unstudied parameters, dense pieces of good quality can be obtained. (auth)

6515 (IS-394) PURE METALS FROM CHEMICAL PROCESSES. H. A. Wilhelm and David T. Peterson (Ames Lab., Ames, Iowa). [Dec. 19, 1961]. Contract [W-7405-eng-82]. 47p.

Some unit chemical processes that are especially effective in obtaining metals of high purity are presented. The three areas of an over-all process for preparing a metal by chemical purification are described. The chemical reactants for the reduction charge may be prepared in special purity, the reaction products may be such as to effect a special purification, and the resultant metal may be subsequently treated to improve its purity. Purification of materials for metal preparation, the chemical reduction to metal, and purification of metal in metallic state by chemical means are discussed. (M.C.G.)

6516 (IS-439) THE APPLICATION OF WAX LAPS TO VIBRATORY POLISHERS. E. N. Hopkins and D. T. Peterson (Ames Lab., Ames, Iowa). [Mar. 9, 1962]. Contract [W-7405-eng-82]. 14p.

Wax lap preparation for the vibratory polisher consists of melting the wax, pouring it into the bowl, and allowing it to solidify. The wax adheres to the bowl without difficulty. Specimens to be polished were mounted in bakelite or lucite. Grooves formed in the surface of the wax can be removed by melting with hot water. (R.J.S.)

6517 (MAB-188-M) STATUS OF REFRACTORY METALS SHEET ROLLING PANEL. Joseph R. Lane and G. Mervin Ault (National Research Council. Materials Advisory Board). Dec. 1, 1962. 31p.

Development of Mo, Nb, Ta, and W alloys to meet preselected mechanical property requirements of sheet material is reported. Problems of chemical analysis, coating, joining, and fabrication are discussed briefly. (R.J.S.)

6518 (NP-12288) DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS. Patricia B. Plate, comp. (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Oct. 1962. Contract AF33(616)-7747. 95p.

A bibliography of 186 references is presented on high-strength alloys, light metals, nonmetallics, refractory metals, coatings, applications, and composites. (R.J.S.)

6519 (NP-12293) OXIDATION RESISTANT HIGH TEMPERATURE PROTECTIVE COATINGS FOR TUNGSTEN. Sixth Quarterly Progress Report, August 1, 1962 to October 31, 1962. (TAPCO. Div. of Thompson Ramo Wooldridge Inc., Cleveland). Contract AF33(616)-8188. 53p. (TM-3543-67)

A method was found to apply the Ti-Zr-(Si-W)-O complex coating to tungsten sheet and eliminate the deleterious crust layer formation previously encountered. The exact nature of the crust formation was not completely established but its formation can be controlled and eliminated. Cyclic oxidation tests at 3450°F were conducted on the W + Ti – Zr – (Si – W) – O system with and without the crust formation. Maximum life at 3450°F for the system free of crust was 17.5 hours while the system containing various amounts of the crust layer failed within 2 to 3 hours. Other factors affecting the ultimate capability of this coating system at elevated temperatures, previously masked by the crust layer-coating reaction, were identified and discussed. Cyclic oxidation tests on the W + (Si – W) – O and W + Ti – Zr – (Si – W) – O (without crust formation) systems were conducted at 1600, 1800, and 2500°F. Oxidation tests at 3000°F were carried out on the W + (Si – W) – O and W + Ti – Zr – (Si – W) – O systems with partial crust layers. Weight change as a function of time at this temperature was determined for periods up to and slightly exceeding 4 hours for each system and representative curves are presented. X-ray-diffraction patterns of the W + Si and W + (Si – W) systems in the as coated and exposed condition were made. Operation of the high temperature furnace for extended periods of time at 3450°F with atmosphere control of the test zone is described. (auth)

6520 (NP-12373) RESEARCH ON PHYSICAL AND CHEMICAL PRINCIPLES AFFECTING HIGH TEMPERATURE MATERIALS FOR ROCKET NOZZLES. Quarterly Progress Report, October 1, 1962–December 31, 1962. Robert Lowrie (Union Carbide Corp. Research Inst., Tarrytown, N. Y. and Union Carbide Corp. Parma Research Center, Ohio). Contract DA-30-069-ORD-2787. 65p.

New data have been obtained on the oxidation of NbC and NbB_2 in slowly flowing CO_2–Ar mixtures at 2250°C (brightness temperature) (BT). A general summary of oxidation under these conditions shows that the carbide and diboride of a given refractory metal oxidize quite similarly, that high-density carbides and diborides of Ti, Nb, and Ta oxidize at about the same rate as ZTA graphite, and that all these oxidize more rapidly than ZrC, HfC, ZrB_2, and HfB_2, which form adherent oxides. At the higher partial pressures of CO_2, HfC is the least reactive of these refractory compounds. The rates of oxidation of $ZrC_{0.4}$, $ZrC_{0.8}$, $ZrC_{0.75}$, ZrN, and ZrB_2–10% $MoSi_2$ in CO_2 all are relatively fast. The products of oxidation of NbC by CO_2 have been identified by x-ray diffraction as NbO and NbO_2. The refractory carbides and borides corrode considerably less rapidly in HCl than in CO_2 at 2250°C (BT) and equivalent partial pressures. The relative reactivities with HCl correlate well with the thermodynamic stabilities of the reaction products: i.e., Ti, Zr, and Hf compounds are more reactive than Nb or Ta compounds, and borides are more reactive than carbides. Single-surface reaction studies made on pyrolytic graphite in a rapidly flowing gas stream show that it is less susceptible to erosion abetted by corrosion than is ZTA graphite. Similar tests were made on arc-melted ZrC, but frequent cracking of the ZrC specimen holders occurred and must be overcome. The reaction of ZrC with H is being studied in a static system. The use of high-density arc-melted samples has overcome the difficulties previously reported of contamination of the specimen by oil during grinding. Zirconium metal appears to be evaporated from the ZrC sample at 2260°C (BT) after C has been removed by reaction with H. The reaction between ZrC and HCl apparently produces $ZrCl_4$ and leaves C on the surface of the sample. Mass spectrometric measurements on the evaporation of ZrB_2, Zr, and B have been combined with Margrave's recent heat capacity data for ZrB_2 to yield an average calculated value of $\Delta H_{298}^{f} = -71.61$ kcal/mole for ZrB_2. The molecular beam apparatus for conducting gas-solid reactions was successfully tried out. A beam of Al atoms was produced and impinged on C. Only Al atoms were detected in the product beam. Thermal expansion was measured for HfC to 2026°C (1.432%) and for NbC to 1770°C (1.263%); it is very nearly equal for ZrC (previously reported), HfC, and NbC. Hall-effect measurements have been made on ZrN, NbN, and the solid solutions ZrC • NbC and ZrC • 3NbC. The resistivity of ZrC was measured to 1000°K, but difficulty was encountered with the Hall-effect measurements made at the same time.

Apparently this is a result of the formation of a very thin oxide film on the contacts. Reflection spectra were measured in the visible range for ten refractory hardmetals. They show a broad, poorly defined absorption band that moves to longer wave lengths for the materials with higher valence electron concentrations. The elastic properties of a ¾-in.-dia. W rod were determined from pulse-echo measurements of sonic velocities at temperatures to 1800°C. Minor anomalies were encountered in the measurements, and these limited accuracy to about ±1%. The thermal conductivities of TiB_2 and TaC were measured by the rectangular bar method. Results of reasonable accuracy were obtained for TiB_2, but difficulties of sample inhomogeneity rendered the TaC results qualitative at best. Measurements on samples of a special hot-pressed graphite of very high density and great anisotropy gave good values of thermal and electric conductivity to 2800°K. More creep tests on arc-melted polycrystalline TiC confirmed the extensive ductility near 1600°C previously reported. Data from an experiment in which the temperature was abruptly increased were used to compute an activation energy for the creep of 163 kcal/mole. Metallographic observations revealed the occurrence of extensive slip or grain-boundary migration, or both, in a sample stretched 5%. A considerably improved batch of HfB_2 was prepared which contained only 0.41% total impurities, neglecting Zr and Ti. The Zr and Ti could have been very greatly reduced by using the more expensive spectrographic-grade Hf oxide as the starting material. This powder was also hot-pressed into small rectangular bars with density 99% of theoretical. Experiments were made on isostatic pressing of carbide powders to make larger specimens. However, it was found that the powders must be ground finer and that a fugitive binder may be required. The special equipment for zone-refining, zone-sintering, levitation melting, and controlled drip-melting is in the final stage of assembly and testing. Accessories for it have been built, and the necessary services installed. (auth)

6521 (NP-12417) DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS. Patricia B. Plate, comp. (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Nov. 1962. Contract AF33(616)-7747. 78p.

A total of 153 annotated references is presented covering the following subjects: high-strength alloys, light metals, nonmetallics, refractory metals, coatings, applications, and composites. Numerical, author, and subject indexes are provided. (R.J.S.)

6522 (NRL-Memo-1361) STATUS REPORT ON THERMOELECTRICITY. J. W. Davisson and Joseph Pasternak (Naval Research Lab., Washington, D. C.). Oct. 1962. 153p.

A review of progress is presented on thermoelectric materials with emphasis on reliability and radiation effects. Other information is included concerning development of devices. It is noted that development of power-generating materials for intermediate temperature ranges continues to move slowly. Development of liquid thermoelectric materials is noted along with magnetic effects at cryogenic temperatures. Continued progress is noted in large refrigeration equipment and in 250-w power generators. (J.R.D.)

6523 (NUMEC-P-51) DEVELOPMENT OF PLUTONIUM-BEARING FUEL MATERIALS. Monthly Progress Letter for Month of October 1962. Karl H. Puechl (Nuclear Materials and Equipment Corp., Apollo, Penna.). Nov. 5, 1962. Contract AT(30-1)-2389. 6p.

Fabrication and characterization of short-term irradiation specimens are reported. A number of continuous precipitation runs for the production of UO_2-PuO_2 and PuO_2 were carried out to ascertain the effects caused by alteration of normal process conditions. Preliminary measurements of the thermal conductivity of UO_2 were made using the high-temperature point source apparatus. (R.J.S.)

6524 (TID-7625) TECHNICAL PAPERS OF THE THIRTEENTH METALLOGRAPHIC GROUP MEETING, HELD JANUARY 14 AND 15, 1959, AT ARMOUR RESEARCH FOUNDATION OF ILLINOIS INSTITUTE OF TECHNOLOGY, CHICAGO, ILLINOIS. H. P. Roth, comp. (Nuclear Metals, Inc., Concord, Mass.). Jan. 24, 1962. Contract AT(07-2)-1. 62p. (NMI-4970)

A total of seven papers is presented. Separate abstracts have been prepared for five papers; the other papers were abstracted previously in NSA. (R.J.S.)

6525 (TID-7625(p.8-19)) THE METALLOGRAPHY OF NIOBIUM–OXYGEN AND NIOBIUM–CARBON ALLOYS. Rodney P. Elliott (Illinois Inst. of Tech., Chicago. Armour Research Foundation).

The phase diagrams for Nb–O and Nb–C have been determined. Microstructures in these systems are distinctive. The typical structures that occur in these systems are illustrated. The principal tool in the determination of these diagrams has been a metallographic investigation of arc-cast alloys. Metallographic laboratory techniques used are essentially those that have been developed for Ti and Zr-base alloys. (R.J.S.)

6526 (TID-7625(p.20-9)) THE REMOTE PREPARATION OF BORON CARBIDE, ZIRCALOY-2 SAMPLES. Bruce D. Wemple (Knolls Atomic Power Lab., Schenectady, N. Y.).

The equipment and techniques used to remotely process irradiated boron carbide, Zircaloy-2 metallographic specimens are described. The results obtained using these procedures are also illustrated. (auth)

6527 (TID-7625(p.30-41)) STRUCTURES IN THE ZIRCONIUM–IRON–TIN SYSTEM. Lee E. Tanner and David W. Levinson (Illinois Inst. of Tech., Chicago. Armour Research Foundation).

The Zr–Fe–Sn system was investigated as a part of a program on the heat treatment of Zr-base alloys. The area of interest was the Zr-rich corner bounded by the binary compounds $ZrFe_2$ and Zr_4Sn between 200° and 1100°C. The important microstructures observed in this system are presented. (auth)

6528 (TID-7625(p.45-51)) IMPURITY CONTENT DETERMINATION OF URANIUM AND HIGH-URANIUM ALLOYS BY VISUAL INSPECTION. D. M. Cheney and A. A. Bauer (Battelle Memorial Inst., Columbus, Ohio).

On the basis of work performed it has been found that with suitable standards and with some practice a metallographer can make reasonably accurate estimates of the amounts of H and C present in U samples by visual metallographic analysis. It is indicated that N analyses may be similarly performed. Routine metallographic specimens of U with alloy additions of up to 10 wt % Nb and Mo have also been successfully analyzed by visual examination with verification being obtained by subsequent conventional analyses. The method has not been applied to other alloy systems but the method can in all probability be applied, particularly for H, to material containing up to about 5 wt % alloy additions. (auth)

6529 (TID-7625(p.52-62)) CINTEL FLYING SPOT MICROSCOPY. A NEW LABORATORY TOOL FOR

METALLOGRAPHERS. T. E. Willmarth (Oak Ridge National Lab., Tenn.).

A scanning spot on a cathode ray tube is imaged through a suitable optical system so as to scan a very small field of the subject. The light passing through the subject will be modulated in accordance with the density and configuration of the subject material and is collected by a photomultiplier cell. Thus the density/time relationship has been changed to a voltage/time relationship. The electrical signal, so formed, is amplified, and can be used to modulate a TV type monitor cathode ray tube, or can be fed to a computing system, using a magnetic drum memory, from which particle count and size distribution data are read off directly on decatrons, as units, tens, and hundreds. (R.J.S.)

6530 (TID-16847) FUEL BEARING FIBERGLAS IN ALUMINUM-BASE FUEL ELEMENTS. Final Report. R. H. Baskey (Clevite Corp. Mechanical Research Div., Cleveland). June 1962. Contract AT(40-1)-2557. 108p.

Al-coated fiberglas containing 50 wt % U_3O_8 in solid solution was consolidated into 99+% dense core material by hot pressing. These core materials were fabricated into Al-clad MTR fuel plates. MTR fuel plates (19) containing Al-coated enriched (93+%) U-bearing fiberglas core sections (10.53 ± 0.2 grams U^{235} per plate) and clad with alclad 5154 were scanned for core homogeneity, formed to correct radius, and mechanically assembled into a prototype MTR fuel element. This element will be tested in the MTR and then examined to determine the effects of irradiation. One capsule with 9 unclad and clad composite specimens containing core material of glass fibers dispersed in an 1100 Al matrix was irradiated. The fibers contained 50 wt % U_3O_8. The materials were irradiated at 100°C to depletion burnups of 17 to 24% of the U^{235} and to a fast-neutron (>1 Mev) exposure of 1.8×10^{20} to 2.6×10^{20} nvt. The surface appearance of the specimens was unchanged. Dimension and density measurements indicated that the materials swelled to the same order of magnitude as alloy fuels which experienced similar irradiation exposures. Fission-gas release could be accounted for by recoil mechanism. The ultimate tensile strengths and elastic moduli were increased while ductility did not change appreciably. Metallographic examination at magnifications up to 1000X did not reveal any evidence of change in the microstructure, and evidence of fission recoil in the matrix was not observed. The fiberglas reinforced the Al core matrix by increasing its strength retention at elevated temperatures. The fiber length and orientation influenced the physical properties. The hot pressed material had tensile strengths up to 19,000 psi at 1000°F when the fibers were aligned parallel to the applied stress. However, the same material with fibers aligned perpendicular to the applied stress had strengths of 7000 psi at 600°F and 5500 psi at 800°F. Stress rupture tests at 400, 600, 800, and 1000°F, to at least 764 hours in some instances, confirmed the excellent strength retention of hot pressed materials. The unclad fiberglas-reinforced Al had strengths of 10,200 and 6,500 psi at 600 and 800°F, respectively. Fuel plates clad with alclad 6061 were 50% stronger at 600°F than the cladding material (alclad 6061). Fuel plates clad with alclad 5154 exhibited, in general, about the same tensile strength as commercial grade 5154 Al. The stress rupture properties of alclad 5154 fuel plates at 400 and 600°F up to 185 hours were less than commercial grade 5154. The elongations and reduction in area of unclad material were normally less than 1%. It usually bent only 7 to 9 degrees around a ¼ in. radius at room temperature without breaking. The clad materials exhibited reductions in area up to 38% and elongations up to 11% at 800°F. Cladding the fiberglas-reinforced Al core with Al alloys increased the formability to the extent that it could be bent up to 90 degrees around a ¼ in. radius at room temperature without breaking. Elevated temperature bend tests at 450 to 550°F indicated that the plates clad with 5154 Al were bent 180 degrees around a ⅛ in. radius without cracking. Plates clad with alclad fiberglas-reinforced Al cracked after bending 30 and 45 degrees around a ⅛-in. radius. (auth)

6531 (TID-17504) RESEARCH ON GRAPHITE. Summary Report, April 1, 1962–March 31, 1963. P. L. Walker, Jr. and H. B. Palmer (Pennsylvania State Univ., University Park. Mineral Industries Experiment Station). Nov. 20, 1962. Contract AT(30-1)-1710. 25p.

Pyrolysis of acetylene is examined. The kinetics of formation of carbon films and the chemistry of carbon suboxide are reported. Heterogeneous gas reaction studies include the kinetics of the carbon-oxygen reaction, rate constants for the carbon-carbon dioxide reaction, thermoelectric power, and magnetic susceptibility in the graphite-iron system, light and electron microscope investigation of graphite oxidation, and electric resistivity of graphite. (R.J.S.)

6532 (WADC-TR-53-373(Suppl.9)) A REVIEW OF THE AIR FORCE MATERIALS RESEARCH AND DEVELOPMENT PROGRAM. Donna J. Tate (Aeronautical Systems Div. Metals and Ceramics Lab., Wright-Patterson AFB, Ohio). Oct. 1962. 250p.

Basic and applied research in the materials area being conducted by the Metals and Ceramics, Non-metallic Materials, Physics, Manufacturing Technology, and Applications Laboratories of the Directorate of Materials and Processes are covered. (auth)

6533 (EURAEC-325) STUDY OF FORMING AND IRRADIATION OF URANIUM MONOCARBIDE. Quarterly Progress Report No. 5, January 1 to March 31, 1962. B. Mansard and P. Rousset (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Apr. 20, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contracts 012-60-5-RDF and AV-033-60-12-RDF. Includes Annex. 45p. A translation.

The study of optimum extrusion conditions for U–C mixtures with stoichiometric content of 4.8% C is reported. Parallel studies have been carried out on the extruded product density evolution after heat treatment without stress. The first rod of natural UC with 4.6% of C (nominal content) has been taken out of the EL_3 pile after 89 days of irradiation with a fission rate of 700 MWJ/T under a mean flux of 4.14×10^{13} n/cm²/s. The first micrographic observations show a perfect behavior of the stainless steel utilized for the canning of the fuel element, as well as of the UC in which only grain growth was observed. The grain surface growth (of about 100%) seems to be due to the thermal regime compelled by this irradiation (1900 hr between 500 and 600°C). The series of irradiations to be made on a UC enriched to 2.7% of U^{235} is awaiting the perfecting of a security system for the elimination of the canning rupture risk inside the EL_3. Dense Zr carbide should provide good thermal insulation between UC and stainless canning. The study of fission gas after cold irradiation of small UC samples is concerned with the perfecting of a process for fission gas extraction at 2000°C. (R.J.S.)

6534 (EURAEC-329) STAINLESS PLATINGS OF LARGE-THICKNESS STEELS. Quarterly Report No. 2,

January 1 to March 31, 1962. (Ghent. Rijksuniversiteit and Soudometal, S. A., Brussels). Work Performed under United States–Euratom Joint Research and Development Program. Contract 040-61-9RDB. 26p. A translation.

Metallurgical examination of five manually plated steel samples with minimum and maximum dilution is reported. In general, the dilutions are less important for Ni than for Cr. This difference is much influenced by the method of welding. A strong penetration increases not only the differences but produces also a general dilution of the deposited metal which manifests itself up to the outside layers. The importance of the texture (anisotropy) differs greatly from one sample to another and even from one layer to another of the same sample. In all of the cases, the reticular planes which appear preferentially on the surface of the sample are the planes corresponding to the cubic faces (200). The variations of the ferrite content do not depend directly on the phase orientation. With the exception of lines of welding in contact with the base metal, the ferrite content of the deposits is relatively constant. Welding conditions have little influence on the importance of the texture, but the maximum of dilution increases its irregularity. (auth)

6535 (EURAEC-352) INVESTIGATION OF ALLOYS OF ZIRCONIUM WITH NIOBIUM AND TIN IN VIEW OF THEIR UTILIZATION AS CANNING MATERIAL IN WATER-COOLED NUCLEAR REACTORS. Special Technical Report No. 1. (Metallgesellschaft A. G., Frankfurt am Main). Apr. 26, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 047-61-4 RDA. 56p. A translation.

A thorough investigation was made of the Zr–3% Nb–1% Sn alloy which had proved promising in the course of a systematic investigation of Zr alloys with Nb and Sn contents. The resistance to corrosion in water and steam under high pressure is best when the alloy is annealed below 590°C, i.e., below the α/β transformation range. When annealing is performed at 580 ± 10°C, a good resistance to corrosion and satisfactory mechanical properties are ensured. Cold deformations up to 60% have but little effect on the resistance to corrosion. It is possible to harden the alloy by quenching from 700 to 800°C and tempering at 350 to 450°C, but the hardened samples have a poor resistance to corrosion. During the corrosion process in water at 350°C and steam at 400°C, the alloy absorbs less hydrogen than Zircaloy-2; at 480°C, the absorption of hydrogen is about exactly the same as for Zircaloy-2. The alloy can be formed into seamless tubes and thin sheets. It can be welded under a protecting gas and in an electron beam, but the welded seams are more subject to corrosion than the nonwelded material. The resistance to corrosion of the welded zone can be improved either by making use of a welding additive with small Nb content or by subsequent annealing of the welded joint. The elastic limit and the tensile strength of the welds are higher than the corresponding values of the initial material. It is possible to weld together Zr-Nb–1% Sn alloys and Zircaloy-2. (auth)

6536 (EURAEC-365) PLUTONIUM RECYCLING. Quarterly Report No. 4, January 1, 1962 to March 31, 1962. (France. Commissariat à l'Énergie Atomique, Paris). Work performed under United States–Euratom Joint Research and Development Program. Contract 037-60-12RDF. 18p. (A Translation)

Preparation of dispersion specimens of MgO + UO_2 for irradiation studies is reported. Fabrication of dispersion specimens of UO_2 in Al_2O_3 was initiated. Other work is reported on electric conductivity and Hall effect in UO_2 monocrystals. Data on the electric conductivity of UO_2–PuO_2 samples are included along with information on an electric conductivity anomaly in sintered UO_2. (J.R.D.)

6537 (EURAEC-377) STAINLESS PLATINGS OF LARGE-THICKNESS STEELS. Quarterly Report No. 3, April 1 to June 30, 1962. (Ghent Rijksuniversiteit and Soudometal, S. A., Brussels). Work Performed under United States–Euratom Joint Research and Development Program. Contract 040-61-9RDB. 46p. A translation.

The properties of three SOUDOTENAX 56 base-steel samples, which were 100 mm thick and were plated manually in three different positions, were investigated by the following methods: normal chemical analysis in steps, face and edge bendings in raw and treated states, optical and electronic metallographic examinations, average and punctual fluorescent analyses, and structural analysis by diffraction. The various results obtained are described. (R.J.S.)

6538 LITHIUM—PRESENT AND FUTURE AND ITS MEANING TO THE CANADIAN MINING INDUSTRY. Raymond W. Hale (Battelle Memorial Inst., Columbus, Ohio). Trans. Can. Inst. Mining Met., 65: 306-9(1962).

The history of Li is briefly reviewed, the major uses of Li and its alloys are presented, and the future outlook of Li is discussed. (R.J.S.)

6539 URANIUM METALLURGY. VOLUME I. URANIUM PROCESS METALLURGY. W. D. Wilkinson. New York, Interscience Publishers, 1962. p.1-755. $18.00.

This volume presents information pertinent to the metallurgical processing of uranium ores and metal and to safe practice in uranium metallurgy. Some of the topics covered are reduction, purification, fabrication, powder metallurgy, and reprocessing of fuel material. (D.L.C.)

6540 URANIUM METALLURGY. VOLUME II. URANIUM CORROSION AND ALLOYS. W. D. Wilkinson. New York, Interscience Publishers, 1962. p.757-1490. $16.00.

This volume presents information and data on the corrosion of uranium and on uranium alloys. Corrosion of uranium by gases, moisture, aqueous media, and nonaqueous media is considered. The uranium alloys are grouped according to type: compound-free, uranium–nonmetal, low miscibility with intermetallic compounds, and miscible. (D.L.C.)

6541 MATERIALS SCIENCE AND TECHNOLOGY FOR ADVANCED APPLICATIONS. Donald R. Mash, ed. Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962. 775p. $12.00.

Problem areas and recent progress in connection with materials for propulsion, space vehicles, missiles, and supersonic aircraft are covered. In addition, electronic applications and space auxiliary nuclear power are covered with regard to important materials aspects. Recent developments in materials and in fabrication techniques are discussed without connection to specific engineering applications. Separate abstracts have been prepared for the papers deemed to be within the subject scope of NSA. (W.D.M.)

6542 MATERIALS REQUIREMENTS FOR CRYOGENIC TEMPERATURE APPLICATIONS. Abraham Hurlich (General Dynamics/Astronautics, San Diego, Calif.). p.45-84 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

The general effects of low temperatures upon the mechanical properties of metals and alloys are discussed, including effects upon strength, ductility, and touchness

(resistance to brittle fracture). Metallurgical variables such as crystal structure, microstructure, chemical composition, and impurities influence the low temperature mechanical properties of metals, as do factors such as notches, stress concentrators, multiaxial stress distributions, and rate of loading. The criteria for the selection of metals for application in cryogenic fueled missiles and space craft are discussed, including consideration of strength/density ratios, resistance to brittle fracture and crack propagation, corrosion resistance, weldability, and formability. Mechanical properties of high strength heat-treatable steels, austenitic steels, aluminum, magnesium, nickel, cobalt, and titanium base alloys are discussed and data are presented on various alloys of these classes which are recommended for use at extreme sub-zero temperatures. Recent data on effects of combined environments of cryogenic temperatures and nuclear radiation are presented in reference to the use of liquid hydrogen as the propellant in nuclear engined space craft. (auth)

6543 INTRODUCTION TO SPACE PROPULSION PROBLEMS. J. E. Hove (Aerospace Corp., Los Angeles). p.85-93 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

Considerations of space propulsion mainly involve the possible trade-offs between propellant mass, structure and auxiliary equipment mass, and payload in order to accomplish a prescribed mission. For long-time deep space missions, chemical propulsion is not normally feasible with any reasonable payload requirements. This is principally because the low specific impulse of such engines gives rise to the requirement of prohibitively large propellant mass transfer and hence initial propellant mass. Thus, electrical and nuclear systems are under study, principally ion and plasma propulsion using nuclear auxiliary power units, and reactor heating of a propellant by surface heat transfer. Some of the advantages and disadvantages of the various propulsion schemes are presented and the general problems discussed, particularly those relating to materials. Such atmospheric nuclear propulsion schemes (such as the ram-jet) give rise to technology useful to the solution of some of the space problems, a brief discussion of such systems is included. (auth)

6544 MATERIAL REQUIREMENTS FOR ION PROPULSION. H. Todd, F. Barcatta, D. Clark, and R. Worlock (Electro-Optical Systems, Inc., Pasadena, Calif.). p.94-122 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

Ion propulsion devices impose new and unique material requirements. High operating temperatures, low pressures, the presence of cesium vapor, and the necessity for high ionization efficiencies, and low electrode sputtering rates create formidable problems. In the ion engine, ionization of cesium is accomplished by effecting its evaporation from a clean porous tungsten surface. During this process the cesium atom loses an electron to the tungsten and becomes positively charged. The resulting ion is accelerated away from the ionizing surface through a negatively charged annular electrode. Neutralization of the cesium ion beam is accomplished downstream by electrons emitted from a high temperature, low work function material developed for this application. (auth)

6545 MATERIALS REQUIREMENTS FOR PLASMA PROPULSION. D. W. Gates (National Aeronautics and Space Administration, Huntsville, Ala.). p.123-35 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

A brief description is given of the engines under discussion, with some of the operation parameters pertinent to the selection of materials. Various propellants and their effects are noted. Some areas beyond present-known technology and/or desirable attributes are given to indicate the desired direction for future research and development. Materials problems external of the engine are mentioned, but concentration is on the electrode and nozzle considerations. (auth)

6546 MATERIALS REQUIREMENTS FOR NUCLEAR RAMJETS. Harry L. Reynolds (Univ. of California, Livermore). p.136-50 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

The nuclear ramjet, as presently conceived, is an unmanned missile traveling at sea level at a velocity in the vicinity of Mach 3, approximately forty miles per minute. Stagnation temperatures are about 1050°F at this velocity. Material requirements for the air frame are similar to those of any supersonic airframe with the exception that weight is a minor consideration and temperatures somewhat higher than stagnation are achieved in the vicinity of the reactor due to radiation heating. The reactor is made of a homogeneous mixture of beryllium oxide and uranium oxide. These ceramic pieces operating at temperatures in excess of 2000°F are held together by an assembly of high temperature nickel base alloys and cooled refractory metals such as molybdenum and niobium. The first reactor in this program has recently been tested at the Nevada proving grounds. A description of this reactor and the test facility are given together with the materials requirements and performance. (auth)

6547 MATERIAL REQUIREMENTS FOR NUCLEAR ROCKETS. Donald P. MacMillan (Los Alamos Scientific Lab., N. Mex.). p.151-63 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

The material problems most unique to the Rover program are principally in the area of fuel element design. Since the nuclear rocket engine is first of all a reactor, the neutron absorption of materials must be small. Among the important non-nuclear characteristics of fuel element materials is retention of strength at high temperature, resistance to thermal shock and thermal stress, and capability of sustaining a high strain rate. The bulk power density of nuclear rocket engines must be of the order of 100 Mw per cu ft. This demands good thermal conductivity if excessive thermal gradients are to be avoided. (auth)

6548 SLIDING CONTACTS AND FRICTION PHENOMENA IN SPACE. F. J. Clauss, C. F. O'Hara, S. P. Drake, and F. B. Cooke (Lockheed Missiles and Space Co., Sunnyvale, Calif.). p.164-98 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

Problems in the operation of such parts as gears, bearings, and sliding electrical contacts that result from the environments to which spacecraft are exposed will be reviewed, with special emphasis on obtaining long-time reliability under orbital conditions together with minimum weight and size. The advantages and limitations of various classes of lubricants and self-lubricating materials for spacecraft applications are reviewed, and new data from current experimental studies are presented. (auth)

6549 PROBLEMS OF THERMAL CONTROL SURFACES IN THE SPACE ENVIRONMENT. R. E. Gaumer

(Lockheed Missiles and Space Co., Palo Alto, Calif.). p.199-214 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

The necessity for thermal control surfaces for space vehicles, the ranges of temperature required for component control, the degree of tolerance allowable for individual component temperature control, and the connection between present day materials research for advanced applications and problems of spacecraft thermal control are discussed. (auth)

6550 PYROLYTIC MATERIALS FOR RE-ENTRY APPLICATIONS. Daniel Schiff (High Temperature Materials, Inc., Boston). p.236-66 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

A general description of pyrolytic materials and their processing is given. The behavior of anisotropic pyrolytic materials to thermal, oxidation and other environmental conditions is discussed for re-entry space vehicles with peak temperatures from 4000 to 6000°F. The materials response is evaluated for transient heating conditions of ballistic missiles and for the quasi-steady state heating of lift and drag type re-entry vehicle. The results of analytical studies on varying physical properties such as the anisotropy in thermal conductivity are discussed. The characteristics of pyrolytic graphite and pyrolytic boron nitride are presented and their anisotropic thermal and mechanical properties correlated with their structures. Property data are reviewed as a function of temperature and compared with other materials of interest. The residual stresses present in these anisotropic materials are discussed and their effects on design and process considerations are presented. (auth)

6551 HISTORY AND RECENT DEVELOPMENTS IN DIRECT ENERGY CONVERSION SYSTEMS. Paul H. Egli (U. S. Naval Research Lab., Washington, D. C.). p.371-407 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

Improved power sources and energy conversion systems are an important long range national problem and of immediate military importance. Various direct conversion processes appear promising for the solution of some of these problems. In thermoelectricity, progress in materials has been good, but much remains to be done. Even at this stage a number of valuable thermoelectric devices can be constructed, particularly cooling devices ranging from small modules for temperature control of electronic parts to submarine air conditioning, and small size power generators for various remote locations including long lived satellite missions. Thermionic emission offers light weight power generators for large power supplies for relatively short missions. Magnetohydrodynamics is confronted with imposing problems associated with the high temperature requirements for operation of more than a few minutes duration. Important improvements are in sight, and continued progress is imperative to provide high density power sources for advanced weapon systems. Photoelectric processes show good improvements toward the goals of lower costs and performance in severe environments. Fuel cells offer exciting possibilities for uses ranging from the main power source for submarines to the auxiliary power on short time space missions. (auth)

6552 SOLAR ENERGY CONVERTERS. Bernd Ross (Hoffman Electronics Corp., El Monte, Calif.). p.431-52 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

A short discussion of semiconductor P-N junctions is given. This will be related to the operation of a photovoltaic device. A method of fabricating a silicon photovoltaic energy conversion device is discussed. Considerations of spectral response and optimization to solar radiation resulting in the development of a solar simulator are described. Special requirements of solar cells operating in earth space are mentioned. (auth)

6553 MATERIALS FOR THERMIONIC CONVERTERS. Coleman Kaplan (Marquardt Corp., Van Nuys, Calif.). p.453-66 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

The basic theory of the thermionic converter is reviewed. Various methods of reducing the space charge limitation of current in a thermionic converter are discussed. In vacuum converters, the effect of space charge can be reduced by very close spacing or by the use of a crossed electric and magnetic field (the magnetic triode). Space charge can also be neutralized by introducing positive ions into the converter. In the cesium diode and triode, the plasmatron converter, and the pulsed diode, positive ions are supplied by ionization of a low pressure gas. Solid materials which emit positive ions when heated are also being investigated as a source of positive ions for space charge neutralization. The electrical and mechanical requirements for the emitter, collector and auxiliary electrode materials are discussed, as well as the problems related to insulators, seals, and electrical leads. The materials problems involved in using the thermionic converter with a nuclear reactor or a combustion chamber as the heat source are mentioned. The nuclear-heated application requires fissionable fuels and reactor structural materials that will withstand high temperatures and radiation damage. The combustion heated thermionic system requires materials with a reasonable lifetime when subject to corrosion and erosion by hot gases. Both applications require materials that are compatible with and can be joined to the electron emitters and insulators of the converter cells. (auth)

6554 SOME RECENT STUDIES OF THE HIGH-TEMPERATURE MECHANICAL PROPERTIES OF URANIUM CARBIDE AND BERYLLIUM OXIDE. R. Chang, G. G. Bentle, and F. E. Ekstrom (Atomics International, Canoga Park, Calif.). p.533-58 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

The high-temperature flow characteristics of polycrystalline uranium carbide and beryllium oxide are compared and discussed with regard to the possible importance of crystal structure, stiochiometry, and purity of the materials. The mechanism of flow for polycrystalline uranium carbide (and zirconium carbide) is that of the climb of dislocations. The flow behavior of polycrystalline beryllium oxide (and aluminum oxide) is at present not entirely understood but may possibly be controlled by the diffusional mechanism of Nabarro and Herring. The current status of the preparation of high purity uranium carbide and beryllium oxide is described and further work to produce higher purity materials than presently available for property measurements is recommended. (auth)

6555 RECENT DEVELOPMENTS IN COLUMBIUM PHYSICAL METALLURGY. Warren I. Pollock (E. I. du Pont de Nemours and Co., Wilmington, Del.). p.576-605 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs. N. J., Prentice-Hall, Inc., 1962.

New information is presented concerning the effect of second phase strengthening as obtained by the solution treatment and subsequent aging of niobium alloys. The susceptibility to age hardening, as well as dispersion strengthening, is imparted to niobium-base alloys by additions of both zirconium and hafnium. The interaction of zirconium with carbon and oxygen is detailed. Phase identification and metallographic studies are reviewed. Suggested avenues of future research are also presented. (auth)

6556 PLASMA-ARC SPRAYING OF SPACE-AGE MATERIALS. Donald R. Mash (Advanced Materials and Processes, Inc., Los Altos, Calif.). p.656-81 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

Plasma-arc spraying is a versatile process which is only beginning to realize the potential predicted for it. Although current applications still largely involve refractory materials such as zirconia and tungsten used in liquid and solid fuel rocket motors, the technology is expanding rapidly to include other materials and other technical areas. Many problems inherent in the fabrication of refractory metals and compounds are being solved by means of plasma-spray techniques. This approach is expected to serve to an increasing extent in the fabrication of the refractory hard materials (carbides and borides) which are growing in importance for aerospace and other advanced applications. Technology developed in connection with aerospace applications is already finding use in other areas. Techniques such as gradated coatings and plasma-forming are widely applicable. Continued efforts to produce better equipment, to improve spray materials and techniques, to understand the effects of process variables, and to develop useful product specifications in certain areas of application will all contribute to the growth of this important fabrication process. (auth)

6557 CORROSION AND MASS TRANSFER IN ALKALI LIQUID METAL SYSTEMS. John R. Weeks (Brookhaven National Lab., Upton, N. Y.). p.709-27 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962. (BNL-5771)

Liquid alkali metals offer attractive properties as coolants for space-vehicle power sources. They are usually contained in the high-melting body-centered cubic transition metals and their alloys: steels at temperatures below 550°C and refractory metals at higher temperatures. Corrosion can occur by two mechanisms: dissolution of the solid metal into the liquid alkali metal, and a chemical—as opposed to intermetallic—reaction resulting from the presence of nonmetallic impurities in either the liquid or solid metals. Dissolution-corrosion is a function of solubility and hydrodynamic factors. It is rare in practical alkali metal systems except where high-Ni container alloys are used. "Chemical" corrosion is a function of the C, O, and N activity in both the liquid and solid metals; it is minimized by "gettering" both the solid alloy and the liquid metal for these impurities, and/or by cold-trapping the coolant to reduce the concentration of soluble oxides. Design of liquid-vapor systems requires knowledge of the relative aggressiveness of the bulk liquid and the fresh condensate. (auth)

6558 JOINING OF REFRACTORY METALS FOR SPACE POWER APPLICATIONS. G. M. Slaughter, C. W. Fox, E. A. Franco-Ferreira, and R. G. Gilliland (Oak Ridge National Lab., Tenn.). p.728-46 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

Since many proposed space power systems utilize refractory metals, extensively, it is evident that a wide variety of components manufactured from these materials will be required. The joining problems associated with the construction of reliable pumps, heat exchangers, and nuclear fuel elements investigated at Oak Ridge National Laboratory are reviewed. (W.D.M.)

6559 A NUCLEAR FUEL ELEMENT FOR SPACE APPLICATION. Charles C. Woolsey (Atomics International, Canoga Park, Calif.). p.747-67 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962.

The fuel element for SNAP-2 utilizes a solid-homogeneous fuel-moderator material, enriched uranium fuel in a matrix of zirconium hydride. The latter has the moderating capability of cold water but maintains this capability up to temperatures as high as 1400 or 1500°F. This temperature limitation results only from the increase in hydrogen dissociation pressure and the attendant hydrogen and pressure containment problems. Properties of the fuel-moderator material have been studied extensively. The material is quite brittle, with mechanical properties somewhat like those of a ceramic. On the other hand, its thermal and electrical properties are more like those of a metal. Resistance to radiation damage is excellent for the limited exposures studied. Cladding material development for the fuel element has been dictated primarily by the hydrogen and pressure containment requirements. (auth)

Corrosion

Refer also to abstract 7552.

6560 (AAEC/E-98) HIGH TEMPERATURE COMPATIBILITY OF 25/20 TYPE AUSTENITIC STAINLESS STEEL WITH CARBON DIOXIDE. E. Lee and A. Draycott (Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Sept. 1962. 12p.

The 25% Cr, 20% Ni type stainless steel has been proposed for use in the Australian High Temperature Gas Cooled Reactor in core structures, and in hot gas ducting. Thus a knowledge of the compatibility of this steel with high pressure CO_2 was required. Rates and mechanisms of corrosion were investigated for machined, vapor blasted, and etched pretreated samples of this steel, exposed to CO_2 up to 5,000 hr in the temperature range 650°C to 800°C at gas pressures from 3 psig to 280 psig. Oxide film flaking was apparent at all temperatures investigated, but was severe only for pre-ground samples at 710°C and above, and for pre-vapor blasted samples at 760°C and above. However, severe intergranular penetration was observed in pre-etched samples on exposure to CO_2 at 650°C and above. Pressure of the gas appeared to have no systematic effect on the corrosion rate, at least in the temperature range investigated. The maximum useful temperature for which the steel could be used would be limited by the amount of oxide flaking permissible. In reactor gas circuits where a small amount of scale flaking could be tolerated, the steel is satisfactory up to 750°C. (auth)

6561 (ARF-2198-34) IMPROVED ZIRCONIUM ALLOYS. Quarterly Report, July 1, 1962–September 30, 1962. D. Weinstein and F. C. Holtz (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Oct. 12, 1962. Work performed under United States–Euratom Joint Research and Development Program. Contract AT(11-1)-578. 8p.

A number of zirconium ternary alloys have been developed for service in 680°F water which meet objectives of corrosion resistance, strength, and hydrogen pickup. Ternary alloys have been developed for service in 750°F steam which are superior to Zircaloy-2 regarding corrosion resistance and strength. (R.J.S.)

6562 (ARF-B6001-1) HIGH-TEMPERATURE OXIDATION PROTECTIVE COATINGS FOR VANADIUM-BASE ALLOYS. Bimonthly Report No. 1, September 13, 1962–November 12, 1962. John J. Rausch and F. C. Holtz (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Dec. 10, 1962. Contract N600(19)59182. 14p.

The basic parameters relating to the pack-siliconizing of V-base alloys are being investigated with the objective of optimizing protective capability and reliability. Coating time, temperature, and the effect of double processing are being evaluated and relationships drawn to the accompanying oxidation resistance and reproducibility. Oxidation behavior and other properties of compounds based on $(V, Nb)Ni_2$, $(V, Nb)Ni_3$, $(V, Nb)Co_2$, and $(V, Nb)Co_3$ were studied at 2000° and 2200°F. Co-containing compounds had relatively poor oxidation resistance, whereas most of the Ni-base compositions exhibited low weight changes. (auth)

6563 (DC-61-7-6) OXIDATION PROTECTIVE COATINGS FOR A TUNGSTEN ALLOY 86.5W–6Ni–3Fe–4Mo–0.5B. W. R. Butts (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). Apr. 1961. For General Electric Co., Aircraft Nuclear Propulsion Dept., Evendale, Ohio. Contract AT(11-1)-171. 29p. (DM-60-310)

Flame sprayed oxides, sealed with refractory glasses, were evaluated and found to prevent oxidation. The best coating system was tested under static oxidation conditions for 1177 hours at 2000°F before initial coating failure was observed. Bonding mechanisms were studied and relationships were shown to exist between type of bonding and coating life. (auth)

6564 (DRI-2056) INTERMEDIATE-TEMPERATURE OXIDATION OF BERYLLIDES. Quarterly Progress Report, June 1 to September 1, 1962. Frank C. Perkins (Denver. Univ. Denver Research Inst.). Sept. 15, 1962. Contract AT(11-1)-1092. 27p.

The oxidation kinetics and characteristics of $ZrBe_{13}$, Zr_2Be_{17}, $NbBe_{12}$, and Nb_2Be_{17} in the temperature range 1200 to 1800°F are described. The beryllides under consideration are subject to catastrophic oxidation and/or metallic disintegration when exposed to oxidizing atmospheres at these temperatures. The principal techniques employed in the investigation include metallography, x-ray diffraction, and thermogravimetric measurements under variable atmospheres. (auth)

6565 (EURAEC-413) IN-PILE CORROSION OF NUCLEAR MATERIALS. Quarterly Report No. 1, March 1–June 30, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucleaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 084-62-3 RDB. 11p. (R-2149)

A new loop has been designed which permits insertion and removal of test specimens to and from the electrochemical cell independently from the reactor cycles. Advantages expected from this loop are a greater number of experiments per reactor cycle and the possibility of specimen inspection when desired. This considerably improves the economy of the reactor channel. Parts of the loop have been tested for proper operation. A prototype of a complete loop is under construction. Though the materials of the final loop will be stainless steel and Inconel, the prototype will be made of aluminum because of long delivery times for Inconel. Experiments on Al have been carried out to establish the effects of measuring conditions on the passive oxide layer, such as the effect of time in contact with pure water or with electrolyte solution, and the effect of repeated passivation on the oxide layer. A new measuring cell was constructed for the use of thin foils to be examined by means of the chronopotentiometric method. Difficulties have been encountered in the etching of Zr-specimens in mixtures of $HF–HNO_3$. Satisfactory results have not yet been obtained. Experiments in the characterization of surface oxide on zirconium specimens after different surface treatments (no etching) gave values for the thickness, the ionic conductivity, and the capacitance of the passive oxide film; these values were in fairly good agreement considering the experimental conditions. However, etching in a $HF–HNO_3$ mixture caused a high scattering in the results. Some experiments in different electrolytes indicate only a slight effect on the oxide layer thickness and on the capacitance of the layer, but a larger effect on the conductivity of the oxide or on the shape of the potential-time curve. In order to give reliable values of the oxide properties, it is necessary to measure the true surface area of the specimens. (auth)

6566 (HW-SA-2307) MATERIALS FOR NUCLEAR POWER REACTOR FUEL DISSOLVERS. R. E. Burns, R. F. Maness (General Electric Co., Hanford Atomic Products Operation, Richland, Wash.): D. C. Drennen, and C. L. Peterson (Battelle Memoral Inst., Columbus, Ohio). Oct. 1961. Contract [AT(45-1)-1350]. 18p.

An alloy was developed which affords greater corrosion resistance to a wide variety of fuel dissolvents such as HNO_3, H_2SO_4, and various fluoride solutions, than any known commercial ferrous or Ni-base alloy. The nominal composition of the alloy in wt.% is 50–Ni, 25–Cr, 16–Fe, 6–Mo, 1–Cu, 0.6–Mn, 0.4–Si, 1–Ti, and 0.02–max C. Corrosion behavior of this alloy is discussed. (J.R.D.)

6567 (HW-SA-2745) HIGH TEMPERATURE AQUEOUS CORROSION IN NUCLEAR REACTORS. R. L. Dillon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 5, 1962. Contract AT(45-1)-1350. 18p.

A discussion is presented concerning aspects of corrosion of widely used reactor materials used in water cooled systems. A description of corrosion associated with advanced water cooled concepts such as nuclear superheaters and those in the supercritical range is also given along with an example of basic corrosion research which may effect material development. (J.R.D.)

6568 (NMI-1905) BERYLLIUM CORROSION. Quarterly Report to United States Atomic Energy Commission for the Period July 25, 1962 to September 25, 1962. J. P. Pemsler and D. S. Kneppel (Nuclear Metals, Inc., Concord, Mass.). Oct. 30, 1962. Work performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-3012. 16p. (EURAEC-506)

Samples of Brush QMV Be powder, hot-pressed or extruded, have shown no indication of accelerated corrosion after exposures up to 145 days in 343°C water. Some localized attack in the form of pits occurred in the first few days of exposure but thereafter the progress of attack was arrested. No improvement in the corrosion resistance of different types of Be in water at 343°C was obtained by pre-oxidation of Be. Extrusions of commercial compacts with varying BeO contents show erratic corrosion behavior. Most of the samples have lasted for 35 days with no signs of accelerated attack. Thus far no correlation is apparent between BeO content and corrosion behavior in

343°C water. High purity Be samples show extremely poor corrosion resistance. Cast and extruded Be alloys of Ni and Cr were corrosion tested, but the appearance of the samples indicated segregation. Previous work had shown that Be–Ni alloys were very promising in corrosion behavior. Corrosion test results in 650°C steam at atmospheric pressure do not appear to correlate with results obtained in 343°C water. (auth)

6569 (NP-12369) INVESTIGATION OF STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALLOYS. Progress Report No. 19, October 1–October 31, 1962. P. L. Jordan (Aerojet-General Corp., Azusa, Calif.). Dec. 12, 1962. Contract DA-04-495-ORD-3069. 4p.

6570 (ORNL-2674) CORROSION OF MATERIALS BY LITHIUM AT ELEVATED TEMPERATURES. Eugene Edward Hoffman (Oak Ridge National Lab., Tenn.). Mar. 23, 1959. Contract W-7405-eng-26. 254p.

Thesis submitted to Univ. of Tennessee.

An investigation was made to determine the corrosion resistance of various materials to lithium in the temperature range 1000 to 1832°F (538 to 1000°C) in both static and dynamic systems. Evaluation of test results was based primarily on metallographic examination, weight-change data, dimensional changes, and chemical analyses. The static tests were conducted in constant-temperature systems in the range 1500 to 1900°F (816 to 1038°C) for time periods of 100 to 400 hours. Pure metals, alloys, cermets, and ceramics were included in the studies. The following materials exhibited good corrosion resistance in static systems: beryllium, chromium, cobalt, niobium, iron, molybdenum, rhenium, tantalum, titanium, tungsten, vanadium, zirconium; cobalt-, iron-, and zirconium-base alloys; cobalt-bonded tungsten carbide cermets, and the ceramic carbides of chromium, titanium, and zirconium. Materials which showed promise in static tests and which were available in the form of tubing or pipe were tested in dynamic systems containing temperature gradients. Lithium flow velocities of one-to-eight feet per minute and temperature differences of 100 to 600°F (56 to 333°C) between hot and cold sections were used. Hot-zone temperatures ranged from 1000 to 1900°F (538 ot 1038°C), and test periods varied between 100 and 3000 hours. Inconel, stainless steels, niobium, molybdenum, vanadium, and zirconium were the materials studied. All but Inconel and the stainless steels were found to be satisfactory at hot-zone temperatures of at least 1500°F (816°C). Niobium and the stainless steels were investigated extensively. Niobium was observed to undergo a type of intergranular corrosion attack in preliminary static and dynamic tests. This type of attack was found to be particularly severe in and near weld zones. A systematic investigation revealed that the attack was due primarily to contamination of the metal by oxygen. Subsequent tests showed that niobium containing less than 100 ppm oxygen was completely resistant to attack in static systems at temperatures as high as 1800°F (982°C) and in dynamic systems at temperatures as high as 1600°F (871°C) and for time periods up to 300 hours. The austenitic and ferritic stainless steels containing less than 0.12 wt % carbon normally exhibited good corrosion resistance in static systems. Occasionally, intergranular penetration was observed in both static and dynamic tests with austenitic stainless steels. This type of attack was found to be particularly severe under the combined circumstances of high-nitrogen-content lithium and precipitated grain-boundary carbides. The high-carbon ferritic stainless steels, such as type 446, always exhibited excessive grain-boundary attack. Both the ferritic and austenitic stainless steels exhibited temperature-gradient mass transfer in flowing, nonisothermal systems at hot-leg temperatures of 1300°F (704°C) and above. In thermal convection loops, lithium flow velocity was found to have a major influence on the rate of mass transfer in the range of velocities studied in this investigation. An analysis of the data indicated that this effect was primarily attributable to the velocity dependence of liquid diffusion in the hot leg. In order to determine the effects of nitrogen and oxygen contamination of lithium on its corrosiveness, sampling techniques and methods of purifying lithium were developed. The solubilities of lithium oxide and lithium nitride in molten lithium were also determined. (auth)

6571 (ORNL-TM-411) CORROSION OF NICKEL-BASE SPECIMENS EXPOSED IN THE VOLATILITY PILOT PLANT MARK III FLUORINATOR. T. M. Kegley, Jr. and A. P. Litman (Oak Ridge National Lab., Tenn.). [Nov. 13, 1962]. Contract W-7405-eng-26. 50p.

The combination of operating temperatures around 550°C with LiF present in the salt baths produces about the same bulk metal losses on Ni and Ni-base alloys as was found by operating at 650°C without Li in the salt baths. The presence of U accelerates corrosion of Ni and Ni-base alloys during the Volatility Process fluorination cycle. Prior F conditioning of L Ni decreases corrosion of the material during subsequent fluorination. Prior F conditioning of INCO-61 weld metal increases the attack on INCO 61 during subsequent fluorination. Bulk metal losses on L Ni and the Ni-binary alloys containing Al, Co, Fe, or Mn are about the same during fluorination at 550°C with Li present in the fluoride salt baths. The presence of the alloying elements, Al, Fe, or Mn, in Ni drastically reduces or eliminates intergranular attack usually found in unalloyed Ni exposed to a fluorination environment. In fluorination environments, the effect of adding Co to Ni on subsequent corrosion by intergranular attack of the binary is unclear. These reported tests showed that serious intergranular attack of a 95% Ni–5% Co specimen occurred. On the other hand, this test series and previous series showed good resistance to this form of corrosion by Ni containing 10 and 20 wt % Co. Unalloyed Ni of greater than commercial purity shows less resistance to bulk metal losses, intergranular attack, and grain-boundary modifications when exposed to fluorination environments than L Ni and all Ni alloys tested. (auth)

6572 (OTS-61-31480) SOVIET RESEARCH ON CORROSION OF SPECIAL ALLOYS. (Office of Technical Services, Washington, D. C.). July 7, 1961. 148p.

An evaluation is presented of current Soviet capabilities in the corrosion of special alloys, with particular attention to materials used in the construction of aircraft and nuclear reactors. It is based primarily on a survey of approximately 1500 references from the Soviet technical literature of the period 1950 to 1960. (auth)

6573 (TID-15280) THE GROWTH OF ALPHA ALUMINA MONOHYDRATE CORROSION PRODUCT ON ALUMINUM. E. C. Hoxie and M. A. Post (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [Mar. 1962]. Contract AT(07-2)-1. 13p.

The formation and growth of alpha alumina monohydrate corrosion product on Type 1100 aluminum was studied by electron microscopy. The nature of the films formed in boiling deionized water, boiling deionized water adjusted to a pH of 5.0 by the addition of nitric acid, and 125-psig steam is shown by a series of electron micrographs. (auth)

6574 (TID-15281) DETERMINING THE SOURCE OF NUCLEAR SYSTEM PIPE WALL RADIATION WITH GAMMA RAY SPECTROSCOPY. R. L. Seidel and S. L. Williams (Knolls Atomic Power Lab., Schenectady, N. Y.). Jan. 1962. Contract [W-31-109-eng-52]. 12p.

A non-destructive radiochemical method taking advantage of transistorized gamma pulse height analyzers was developed by which the amount and nature of radioactive deposits both long and short-lived on any system surface can be determined. Additional information such as system corrosion rates and corrosion product distribution in the system can be estimated from the data. The basic measurements consist of: radiochemical analyses of corrosion products (crud) in the coolant, dose rate measurements on any system component, and gamma spectrum measurements on the component. The coolant crud sample is taken before reactor shutdown by filtering a measure quantity of the coolant. (M.C.G.)

6575 (TID-17384) MASS TRANSFER INVESTIGATION IN LIQUID METAL SYSTEMS. Progress Letter No. 38, August 1, 1962–August 31, 1962. R. W. Lockhart (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Sept. 4, 1962. Contract AT(04-3)-189. 13p.

Stainless steel and Na samples were analyzed after loop testing to determine the composition change of a stainless steel surface exposed to liquid Na. The composition gradient was found to be steep near the surface, whereas the surface Cr and Ni contents were very low. (R.J.S.)

6576 (TID-17386) MASS TRANSFER INVESTIGATION IN LIQUID METAL SYSTEMS. Progress Letter No. 39, September 1, 1962–September 30, 1962. R. W. Lockhart (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Oct. 5, 1962. Contract AT(04-3)-189. 10p.

Stainless steel and Na samples were analyzed after loop testing to determine mass transfer behavior. (R.J.S.)

6577 COMPARATIVE STUDY OF THE OXIDATION KINETICS OF MAGNESIUM IN OXYGEN, NITROGEN, AND HUMID SYNTHETIC AIR AT HIGH TEMPERATURES. Raymond Darras, Jean Paidassi, and Francis Lerov (Centre d'Études Nucléaires, Saclay, France). Compt. Rend., 255: 903-5(July 30, 1962). (In French)

The oxidation kinetics of Mg in the presence of a humid mixture of 20% O_2 and 80% N_2 (by volume) in the temperature intervals 400 to 475 and 475 to 600°C is identical to that observed in nitrogen and humid oxygen. An hypothesis capable of explaining this peculiarity is proposed. (tr-auth)

6578 BIBLIOGRAPHY ON CORROSION PRODUCTS IN HIGH-TEMPERATURE WATER SYSTEMS. Corrosion, 18: 440t-8t(Dec. 1962).

References (133) on corrosion by high purity and related waters in nuclear power and steam generating plants are given to reports, journals, conferences, and patents published from 1928 to 1958. (P.C.H.)

6579 STUDIES ON THE OXYGEN GRADIENTS IN CORRODING ZIRCONIUM ALLOYS. J. P. Pemsler (Nuclear Metals, Inc., Concrod, Mass.). J. Nucl. Mater., 7: 16-25(Sept.-Oct. 1962). (In English)

The oxygen gradient beneath the oxide film on zirconium alloys corroding at various temperatures has been measured. The technique used consisted of observing, as a function of voltage, the disruption of an anodically deposited interference film. This mottling of the anodic film varied in a complex manner with the oxygen content of zirconium. Experimentally determined gradients were related to a theoretical expression involving the diffusivity, rate of corrosion and time of corrosion. These data enable accurate quantitative predictions of the oxygen gradient. A knowledge of the gradient is especially useful in understanding corrosion at high temperatures where the oxygen penetration occurs to a greater extent than at lower temperatures. (auth)

6580 CORROSION OF ALUMINUM IN HIGH PRESSURE STEAM AT TEMPERATURES ABOVE AND BELOW 320°C. Tatsuo Kondo, Cho Akutsu, and Masayuki Kawasaki (Japan Atomic Energy Research Inst., Tokyo). Trans. Japan Inst. Metals, 3: 110-18(Apr. 1962). (In English)

Studies of the corrosion of aluminum in high temperature steam, including reaction kinetics and structural observations of corrosion products, were carried out using specially designed autoclaves capable of obtaining high temperature and pressure conditions simultaneously. There was a remarkable difference in corrosion behavior between the temperature ranges above and below 350°C, due to the transition of the oxide formed on the surface of the metal. The corrosion process in the low temperature range up to 320°C had a parabolic time dependence represented by the formula $\Delta W^2 = kp \cdot t$ or $\Delta W^2 = C + kp \cdot t$ from which the activation energy, ΔH, was calculated to be about 32 kcal/mole, which approximately agrees with the value obtained from the aqueous corrosion result in the same temperature range. From the experiment on the transition by hydrothermal treatment of bulk oxide it was suggested that the corrosion of aluminum in the böhmite-forming range is characterized by the inward-hydration process of the oxide. At higher temperatures, at which steam is superheated, the corrosion was negligibly small. However, a localized penetration attack occurred which proceeded very rapidly, and was quite randomly distributed. The relation between penetration-induction time and steam pressure was determined to be $t_i = C_1 \cdot p^4$, from which the pressure dependence of the corrosion rate was derived as $k = C_2 \cdot p^4$. This relation agreed with that for the low temperature range reported by others. A very thin oxide film was removed from the metal surface and analyzed with an electron microscope; it was determined to be amorphous oxide with dispersed nuclei and grown whiskers of α-Al_2O_3. A number of hydrogen bubbles were observed to be agglomerated at the grain boundaries of the metal by the metallographic technique. The mechanism of the penetration attack is thoroughly discussed with emphasis on the whisker formation attributed to the stress by the hydrogen agglomeration in the underlying metal. (auth)

6581 CONTRIBUTION TO THE DEVELOPMENT OF CORROSION-RESISTANT ZIRCONIUM ALLOYS WITH HIGH STRENGTH FOR REACTOR CONSTRUCTION. Kurt Anderko, Wilhelm Jung-Koenig, Herbert Richter, Hans-Walter Schleicher, and Ulrich Zwicker (Metallaboratorium der Metallgesellschaft A. G., Frankfurt am Main). Z. Metallk., 53: 503-12(Aug. 1962). (In German)

The corrosion resistance of zirconium alloys containing up to 5% niobium and up to 1% tin with additions of palladium, chromium, and molybdenum was investigated by exposing the specimens to 350°C water and 400 and 480°C steam. With an appropriate heat treatment the zirconium-niobium alloys have nearly the same corrosion resistance as Zircaloy-2. The best corrosion resistance was attained by annealing below the α-β transformation temperature of 590°C. With this heat treatment the corrosion resistance is independent of the niobium content. Annealing above 600°C causes the appearance of β_Z, which has an unfavorable effect on the corrosion behavior. The effect of the heat treat-

ment is greater at the lower corrosion temperatures. Tin additions have a favorable influence in 350°C water, no effect in 400°C steam and an unfavorable influence in 480°C steam. Niobium-containing alloys pick up less corrosion-produced hydrogen than Zircaloy-2. Annealing in a hydrogen atmosphere results in a lower hydrogen pick up rate in the niobium-containing alloys than in Zircaloy-2. An alloy with 3% niobium and 1% tin has excellent corrosion resistance, hydrogen pick-up, and strength properties. Long-term creep tests show a clear superiority of the Zr3%Nb1%Sn alloy over the Zr2%Nb alloy and Zircaloy-2. (auth)

6582 THE OXIDATION OF URANIUM AT AN OXYGEN PARTIAL PRESSURE OF 10^{-3} TORR IN THE TEMPERATURE RANGE FROM 200 TO 370°C. Erich Gebhardt, Hans-Dieter Seghezzi, and Rolf Rothenbacher (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 513-16(Aug. 1962). (In German)

Uranium is oxidized at a constant pressure of 10^{-3} mm/Hg O_2 and temperature between 200 and 370°C. During 12 hours oxidation three different stages are observed. Their transition points are marked by breaks in the kinetic curves. In any case an UO_2 layer is initially formed on the metallic uranium in the above mentioned temperature range. At higher temperatures a small solubility of oxygen in uranium probably takes place (stage I). In the lower temperature range (197 to 232°C), UO_2 picks up oxygen during a linear oxidation stage (II). Finally in an also linear stage (III) a tetragonal oxide appears with the approximate composition $UO_{2.3}$. In the medium temperature range (290 to 323°C) a mixed oxide consisting of UO_2 and a phase similar to U_3O_8 is found in stage III. After several hours oxidation at 372°C, UO_2 is no longer detected. The curve representing the changes in resistance due to 12 hours oxidation as a function of the oxidation temperature shows a sharp break at about 230°C which clearly reveals the change of the oxidation mechanism. The oxides originating from the oxidation process were determined electrochemically and by x-ray and conductivity measurements. Any discrepancies can be explained by a small solubility of oxygen in uranium. (auth)

6583 CORROSION OF REACTOR MATERIALS. VOL. I. Proceedings of the Conference on Corrosion of Reactor Materials Held by the International Atomic Energy Agency, Salzburg, Austria, June 4-5, 1962. (International Atomic Energy Agency, Vienna). Proceedings Series. Sept. 1962. 539p. (STI/PUB/59). $10.00; 210s; NF 40; DM 35(IAEA).

A total of 22 papers are included. Separate abstracts are provided for five papers; the remaining papers were abstracted earlier. (R.J.S.)

6584 KINETICS OF FAST INTERFACIAL REACTIONS. H. E. Hoelscher and C. Cowherd, Jr. (Johns Hopkins Univ., Baltimore). p.11-26 of "Corrosion of Reactor Materials. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

An analysis is presented of the problems associated with the study of the kinetics and mechanism of fast interfacial chemical reactions. It is difficult to obtain meaningful kinetic information from such systems because of the intruding influence of the diffusional processes and their almost inevitable influence on the data and conclusions from such studies. Such difficulties have hindered progress toward an understanding of metal dissolution and corrosion and other similar processes. A detailed scheme for the analysis of suitable experimental data to yield the kinetics of the surface reaction is presented. An experimental program designed to test this analytical procedure is described. Some results from this study are presented. It is concluded that the proposed technique does permit the determination of the kinetics of the surface reaction divorced from the effects of molecular diffusion. Studies intended to make use of the technique for metal dissolution reactions are in progress. (auth)

6585 SOME EFFECTS OF HYDROGEN ON THE CORROSION MECHANISM OF METALS. J. S. Llewelyn-Leach and A. Y. Nehru (Imperial Coll. of Science and Tech., London and Royal School of Mines, London). p.59-75 of "Corrosion of Reactor Materials. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Theories to account for the well documented effects of H_2 on the corrosion of U, Zr, and other oxide-covered metals have primarily been concerned with possible effects on the mechanical properties of the oxide–metal system. The results of recent studies of the corrosion kinetics of U have shown that cathodic polarization can result in greatly increased corrosion rates during both the protective (time-dependent) region and the non-protective (time-independent) region of corrosion. This has suggested a different possible mechanism for the effect of H_2, involving its solution in the oxide. Studies of the electrochemical-electrode properties of oxide-covered metals have shown that the presence of H_2 may in some circumstances greatly increase the electronic conductivity of the surface oxide without changing its thickness. This increase in conductivity can in turn permit an increase in the ionic diffusion rate in the oxide after the model for AgS_2 developed by Wagner. (auth)

6586 MEASUREMENT OF RESIDUAL STRESSES IN STEEL PLATES CLAD WITH STAINLESS STEEL. G. Hillmann, W. Hofmann, and H. Schimkat (Technische Hochschule Braunschweig, Ger.). p.93-103 of "Corrosion of Reactor Materials. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

The determination of residual stresses in clad plates is of interest in a double respect: type and value of the residual stresses being known, the admissible external (mechanical) load of the compound material can be determined on this basis; and the tendency of stress corrosion depends on the type of residual stress. Two general methods of calculation were developed for the determination of the residual stresses in a compound material of any combination of metals and any proportion of plate thicknesses. The combination of austenitic steel as a cover and of boiler-plate as a basic material were examined. The thickness of austenitic steel amounted to 15.5% of 19.5-mm total thickness. The problem was restricted to the case of the thin clad beam. Thin beams of 240-mm length, 10-mm width, and 19.5-mm thickness were cut out from a bigger plate. For extension of the investigations of the uniaxial state of stress to the biaxial state of stress, three beams forming a triangle within the plate would have to be examined. This research has not yet been undertaken. Residual stresses were calculated from the changes of length caused by the removal of layers from the original plate thickness. The changes of length were determined with the aid of an Abbe-Comparator at constant temperature with a mean error of ±0.2 μm. The gauge length was 40 mm. One of the above-mentioned methods of calculation was applied by means of an electronic digital computer. The following three conditions of material were examined: (1) specimen stretched by 10%; (2) specimen annealed at 1100°C and steadily and slowly cooled; and (3) specimen in the state of delivery. The measurement of the specimens delivered showed compression stresses in the two outer zones, i.e., in the top

and bottom sides of the plate, but tensile and compression stresses in the middle of the plate. Tensile stresses in the outer layers and compression stresses in the middle of the plate were determined in the specimens under (1) and (2). With respect to the tendency of stress corrosion in the presence of corroding surroundings the state of delivery of the plates is therefore most favorable. On the contrary, strongly deformed compound material (specimen 1) and annealed plates (specimen 2) are likely to show an unfavorable reaction. (auth)

6587 PROBLEMS OF CORROSION AND DEPOSITION ON FUEL ROD CLADDING OF THE CANADA-INDIA REACTOR. V. Surya Rao, V. V. Kothare, J. Shankar, and K. S. Venkateswarlu (Atomic Energy Establishment, Trombay, India). p.161-79 of "Corrosion of Reactor Materials. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

After criticality was attained on July 10, 1960, severe difficulties were experienced at CIR in maintenance of the required cooling-water flow rates through the annulus around the U rods in the reactor. There was also serious bacterial growth in the cooling water, which, together with the corrosion products, deposited on the Al cladding surface of the fuel rods. Further investigations revealed that pitting corrosion of the Al cladding had also started. This corrosion resulted in severe blisters on the cladding surface, thereby blocking the cooling-water passages. For inhibition of bacterial growth in the cooling water, $K_2Cr_2O_7$ was added to the system. When the reactor was taken to high power, low water-flow rates through the rod annuli were again observed. The corrosion of Al cladding was severe enough to cause fission products from some of the rods to escape into the cooling-water stream. Investigations of the blistered cladding surface indicated presence of elemental Cu in the deposit. This Cu was probably the cause of the Al corrosion. In order to keep the corrosion products in the cooling-water system at a minimum level, a feed-and-bleed system was started in March 1961; in this system demineralized, de-aerated, and sterilized water is pumped constantly into the circulating loop at the rate of about 20,000 gal (imp)/d, an equal amount of loop water being drained continuously. This has maintained the purity of the cooling-water system within the required limits. This also helped to reduce the $K_2Cr_2O_7$ of the system in a short period of time. A normal U rod, installed out-of-pile, through which the system water has been circulated for several months, has not shown any corrosion of the Al surfaces. The reactor was restarted in May 1961 with fresh charge of fuel, but once again the cooling-water flow rates through individual fuel rods dropped rapidly. The cause of this drop was established to be the presence of $K_2Cr_2O_7$ in the cooling-water system. Hence the quality of cooling water was altered by replacement of the dichromated water with demineralized, sterilized water. The cause of the fall in the flow rates of the cooling water was determined to be due to a deposit on the Al surfaces in the annuli of the fuel rods. Analysis of the deposit showed that it contained Fe and Cr, the latter formed by radiation decomposition of the dichromate in the water and by the radiative capture of neutrons. The deposit from all the fuel rods was removed by circulating solutions of special chemical composition which did not attack Al. The reactor was restarted in November 1961 with the chemically cleaned fuel rods. The reactor power was gradually raised to 30 Mw, at which the flow rates of the cooling water have been satisfactorily maintained. (auth)

6588 CORROSION ASPECTS OF REACTOR DECONTAMINATION. J. A. Ayres (General Electric Co., Richland, Wash.). p.199-240 of "Corrosion of Reactor Materials. Vol. I." Vienna, International Atomic Energy Agency, 1962. (HW-SA-2420). (In English)

During normal operation, reactors may become contaminated either as a result of activation of corrosion products or by release of fission products and rupture debris from a failed fuel element. When contamination becomes excessive, it may be necessary to decontaminate all or part of the reactor system. Decontamination is essentially a controlled corrosion process, in which the film is removed along with a small amount of the underlying metal. The reagents used are usually either strongly acidic or strongly alkaline and are similar to the mixtures used for pickling or metal cleaning. The acidic solutions attack C steel and Al quite vigorously unless suitable inhibitors are added. The most satisfactory inhibitors are those used in pickling solutions, organic compounds having one or more strongly polar groups. The incremental corrosion caused by the decontaminating agents results not only from the actual removal of metal during the decontamination but also from an enhanced rate of attack during subsequent operation as a result of the removal of the protective film. In the accelerated cyclic corrosion testing, the shape of the curve representing weight loss as a function of number of decontamination cycles depends on the degree of attack of underlying metal. The non-uniform corrosion often is the most troublesome. In decontaminating pressurized-water systems, several types of non-uniform attack were encountered, with both alkaline and acidic solutions, resulting in very deep pits and crevices in special alloys, along weld junctions or in pump bearings. These problems were alleviated by special equipment design, exclusion of oxygen, and addition of suitable inhibitors. Many of the corrosion effects were not evident immediately but appeared only after several decontaminations had been completed. One of the most effective methods of evaluating decontamination corrosion effects is cyclic testing in which the materials are exposed alternately to the standard operating conditions and to the decontaminating agents. (auth)

Fabrication

Refer also to abstracts 6434 and 7592.

6589 (ASD-TDR-62-670) THE EXTRUSION, FORGING, ROLLING, AND EVALUATION OF REFRACTORY ALLOYS. D. R. Carnahan and J. A. Visconti (Westinghouse Electric Corp., Blairsville, Penna.). July 1962. Contract AF33(616)-8325. 105p.

Metallurgical programs were conducted on the extrusion, forging, and rolling of arc cast Mo–25%W–0.1%Zr, Mo–0.5%Ti–0.08%Zr–0.02%C, and W–0.57%Nb alloys. Each of the three alloys was worked successfully by extrusion and subsequent reworking. The extrusion process, as established in previous work, remained primarily the same. However, extrusion temperatures exceeding 4200°F were reached in the working of a group of W-base alloys. The maximum temperature attained was 4320°F. In addition, the extrusion process was applied to a variety of refractory alloys in order to supply wrought material for other contractors and governmental agencies. The extrusion data are contained as a portion of the work, but the metallurgical evaluation is not included. (auth)

6590 (ASD-TDR-62-700) INVESTIGATION OF SINTERABLE MgO POWDERS AND CERAMICS MADE FROM THEM. M. J. Snyder, A. A. Rudnick, W. H. Duckworth, and C. Hyde (Battelle Memorial Inst., Columbus, Ohio). June 1962. Contract AF 33(616)-7733. 48p.

The fabrication of dense reproducible specimens suitable for strength measurements and having controlled microstructural differences was attempted. A sinterable high-purity magnesia powder, developed in an earlier phase of the program, was used. Procedures used earlier to produce small, rather crude specimens, could not be applied directly to controlled production of the quantity of large specimens needed. The sintered densities of the larger specimens were lower, and the variability from one lot to the next was greater. The major source of variability appeared to reside in the isostatic pressing operation. This unexpected sensitivity to forming conditions other than pressure suggests the need for further research on processing effects in ceramics made from sinterable powders. A portion of the effort was devoted to analysis and development of the diametral-compression test wherein short cylinders are broken by applying a load across a diameter. Procedures were established for measuring a tensile strength by this method. (auth)

6591 (ASD-TDR-62-734) INVESTIGATION OF THE STRENGTHENING MECHANISMS OF DISPERSION-STRENGTHENED ALLOYS. Richard J. Murphy, Varadachari Sadagopan, and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge). May 1962. Contract AF33(616)-8085. 24p.

To produce dispersion-strengthened alloys with higher strength properties than oxide dispersion-strengthened systems, Ni–TiB_2 and Ni–TiC were selected. Dilute binary alloys of C, B, and Ti in Ni were prepared both in bar and powder form. Diffusion couples between dilute alloys of Ni–C and Ni–Ti as well as between Ni–B and Ni–Ti were examined in a preliminary way. Lack of appreciable diffusion across the boundary motivated the preparation of alloys by means of powder interactions. Positive interactions were observed but measurements of intermetallic particle size and interparticle spacing were not made. Use of a higher Ti alloy shows more extensive diffusion interaction, suggesting use of less dilute alloys. Transmission electron microscopy is being used to observe strain fields associated with dispersed particles, comparing observations in aged alloys, oxide dispersion-strengthened alloys, and intermetallic dispersion-strengthened alloys. (auth)

6592 (ASD-TDR-62-781) VACUUM ARC MELTING OF A TUNGSTEN ALLOY (TUNGSTEN–MOLYBDENUM–COLUMBIUM). George A. Reimann (Westinghouse Electric Corp., Blairsville, Penna.). July 1962. Contract AF33(616)-7459. 74p.

A satisfactory melting technique was established for the production of fine-grained, homogeneous, high quality, tungsten base alloy ingots. The 88%W–6%Mo–6%Nb alloy originally selected for the program was discarded because of ingot cracking and replaced by a 92%W–6%Mo–2%Nb alloy. The reduction of Nb from 6 to 2% permitted ingots, 6 to 9 in. in length. Macroexamination revealed a mixture of fine, equiaxed grains and short, thin columnar grains. Seven ingots of the 92%W–6%Mo–2%Nb composition were extruded successfully at 4000°F, using ratios of 4.4:1, 5.7:1, and 7.5:1. The extruded material was forged and rolled to determine workability. A time, temperature, recrystallization study was conducted on forged specimens of the 92%W–6%Mo–2%Nb alloy. (auth)

6593 (ASD-TR-7-784(VII)) THE DEVELOPMENT OF OPTIMUM MANUFACTURING METHODS FOR COLUMBIUM ALLOY SHEET. Interim Technical Engineering Report, January 1, 1962–September 30, 1962. John B. Guernsey (Crucible Steel Co. of America. Midland Research Lab., Penna.). Dec. 1962. Contract AF33(600)-39942. 123p.

Sheet has been produced from the F48 and D31 alloys in widths up to 24 in. and thicknesses from 0.020 to 0.063 in. Sizes to 36 in. × 96 in. seem feasible for both alloys. Processing of F48 sheet is both difficult and expensive owing to special techniques required. The D31 alloy can be processed to high quality sheet with only minor modifications of conventional techniques. Better flatness and surface finish can be obtained for the D31 alloy than for F48. (auth)

6594 (BRB-66) MANNESMANN ROTARY PIERCING OF URANIUM. Terminal Report. J. A. Fellows (Mallinckrodt Chemical Works. [Uranium Div.], Weldon Spring, Mo.); Q. C. Carloni, and L. Lewis (Bridgeport Brass Co., Conn.). May 18, 1962. Contract AT(30-1)-1405. 41p.

Four campaigns were undertaken to determine the feasibility of rotary piercing U billets to tubing in the alpha phase. A host of parameters including billet temperature, roll opening, entrance angle of the roll surface, angle of obliquity between the roll axes and the axis of the billet, and piercing point location were varied during the campaigns, but to no avail. All attempts resulted in dudded billets. However, it was demonstrated in the third campaign that the fabrication of tubing by rotary piercing in the gamma phase range may be easily accomplished. (auth)

6595 (DC-61-7-18) PRODUCTION OF MASSIVE HYDRIDED ZIRCONIUM. W. M. McCain (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). July 14, 1961. Contract AT(11-1)-171. 41p.

Procedures are set forth for the production of massive hydrided Zr sections. Included are the specification of raw material, a description of equipment used, typical procedures, and excerpts of procedure logs. The effects of some processing variables are discussed. (auth)

6596 (DC-61-7-27) PROPOSED LiH CASTING BY THE SAND SUPPORT-LOCAL HEAT METHOD. J. G. Attanas (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). July 14, 1961. Contract [AT(11-1)-171]. 28p.

A new method for casting lithium hydride is presented in which costly fixtures and a retort furnace are replaced with a simple container holding sand to support the casting while it is being heated by directly attached strip heaters. A comparison of the two methods is made. The status of the proposed method is made and pertinent data and drawings are included. (auth)

6597 (DMIC-176) DEPARTMENT OF DEFENSE REFRACTORY METALS SHEET-ROLLING PROGRAM. Status Report No. 2. H. R. Ogden (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Oct. 15, 1962. Contract AF33(616)-7747. 37p.

The status of the Department of Defense Refractory Metals Sheet-rolling Program is summarized. (auth)

6598 (SCTM-39-62(25)) ELECTRONIC SHAPING. W. D. Raburn (Sandia Corp., Albuquerque, N. Mex.). Aug. 1962. Contract [AT(29-1)-789]. 10p.

Ten electronic techniques available for shaping hard, tough, fragile, or heat sensitive materials which require close tolerances, smooth surface finishes, fast cutting rates, and difficult shapes are described. Cutting rates and results are also listed. (auth)

6599 (TID-17340) HELICAL FINNED TUBE DEVELOPMENT. Technical Report No. 272-235. E. A.

Murphy and J. G. Klein (Brush Beryllium Co. Cleveland). June 30, 1962. Contract AT(40-1)-2912. 63p.

Results of work directed toward development of a process for the fabrication of helical finned Be tubing by warm extrusion and drawing techniques are described. Physical and mechanical property data are included. (auth)

6600 (EURAEC-354) INVESTIGATION ON ALLOYS OF ZIRCONIUM WITH NIOBIUM AND TIN IN VIEW OF THEIR APPLICATION AS SHEATHING MATERIAL IN WATER-COOLED NUCLEAR REACTORS. Special Technical Report No. 3, (Metallgesellschaft A. G., Frankfurt am Main). May 18, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 047-61-4 RDA. 35p. A translation.

The alloy Zr–3% Nb–1% Sn can be machined into thin-walled, seamless tubes such as are required for use in reactors. For the fabrication of tubes by extrusion, cold-rolling (Mannesmann process), and drawing, it is best to use as starting material thick-walled extruded tubes. The extruded tubes have a double fiber texture. The scattering in the orientation of the hexagonal basal plane parallel to the wall of the tube increases with decreasing degree of extrusion. In the two first cold-rolling stages, the extrusion texture remains practically unchanged. Drawn tubes exhibit an annular fibrous texture which was beginning to take shape in the third reciprocating rolling run on account of an increase in the scattering. Annealing stages at 575 to 750°C do not alter the texture. Extruded and rolled tubes exhibit the same creep behavior as extruded and swaged rods of the same alloy, so that the data obtained with rod material could be applied directly to seamless tubes. In the cross-fold and expanding tests, the alloy meets the standards required of Zircaloy-2. (auth)

6601 (EURAEC-372) FABRICATION OF SWAGED FUEL ELEMENTS. Quarterly Report No. 8, April 1 to June 30, 1962. P. Himmelstein, F. Hofmann, H. Kroll, B. Liebmann, and O. Neumann (Nuklear-Chemie und-Metallurgie G.m.b.H., Wolfgang bei Hanau am Main, Germany). Work Performed under United States–Euratom Joint Research and Development Program. Contract 062-61-7RDD. 33p. A translation.

The tests to examine the burn-out of W electrodes in the UO_2 melting furnace without powder supply were concluded. In the subsequent melting tests the electrode burn-out was about five times higher than in the case of the no-load tests. It was observable, however, that only approximately 25% of the electrode burn-out reaches the melt. For swaging tests, V2A tubes with dimensions 18 × 0.4 and 18 × 0.3 mm were mainly utilized. The accuracy of the tubes was verified, and an ultrasonic vibration test of the wall thickness as well as a flaw and cracking test were carried out. The precompacting of the UO_2 was effected by vibration. When utilizing all the powders occurring during grinding, without sieving of the grain fractions, a compacting of approximately 80% theoretical density (T.D.) was attained. Systematic grinding and vibration tests were commenced with a view to obtaining a pre-compacting which is reproducible to the greatest possible extent. Further swaging tests were performed on a four-jawed machine. The cold swaging densities obtained were, after a 40% cross-section reduction, of the order of 89 to 90% T.D. Various dry and wet lubricants were tried, but their lubricating properties proved to be similar. In hot swaging tests on tubes sealed with quartz wool and wad and subsequently pointed, no changes in the stoichiometry of the UO_2 were observable. Heat conductivity measurements on swaged samples showed that the heat conductivity of swaged UO_2 with 93.7 and 91.2% T.D. amounts to only 25 to 40% of the heat conductivity of sintered UO_2 pellets. (auth)

6602 (EURAEC-392) STUDY ON THE APPLICATION OF ELECTROSLAG VERTICAL WELDING, TO THICK STEEL PLATES UNDER WORKSHOP OR YARD CONDITIONS. Quarterly Report No. 2, April 1–June 30, 1962. (Chantiers de l'Atlantique Penhoet-Loire, Paris). Work Performed under United States–Euratom Joint Research and Development Program. Contract 054-61-12RDB. 47p. A translation.

The mechanical properties of base steel plate were investigated. Preliminary temperature measurement tests were carried out to study the causes of errors in the thermocouple measuring system. (R.J.S.)

6603 (JPRS-16573) PROBLEMS ON THE THEORY OF THE PROCESS OF PRESSING METAL POWDERS AND THEIR MIXTURES. G. M. Zhdanovich. Translation of "Nekotorye Voprosy Teorii Protsessa Pressovaniya Metallicheskikh Poroshkov i ikh Smesi", Minsk, 1960. 100p.

A method of mathematical analysis of the main quantitative aspects of compaction of metal powders and their mixtures is presented. The theory is based on a method of determining the mathematical criterion of the effective hardening of an arbitrary massive metal model. Experiments were carried out that confirmed the accuracy of the formulas derived. (M.C.G.)

6604 LEAD SHIELDS FOR NUCLEAR SHIELDING. Nucl. Energy, 458-63(Dec. 1962).

The technical aspects of lead shielding construction are discussed. Special attention is given to specially designed units of large dimensions. Casting techniques and fabrication from sheet slab or extruded sections are reviewed. (P.C.H.)

6605 BRAZING THIN BERYLLIUM WINDOWS. John P. Papacosta, David M. Murdock, and R. Wayne Crews (Stanford Research Inst., Menlo Park, Calif.). Rev. Sci. Instr., 33: 1289-90(Nov. 1962).

Thin, high-vacuum Be windows were vacuum brazed to Cu supports for electronic devices, using small frames of 630-705°C In–Cu–Ag brazing alloy. The edges of the Be windows were coated with Cu before brazing. The brazing procedure is described. (D.L.C.)

6606 METALLOGRAPHIC STUDIES OF Al–Ni–U BONDS IN NUCLEAR FUEL ELEMENTS. R. H. Todd (General Electric Co., Schenectady, N. Y.). Trans. Am. Soc. Metals, 54: 785-7(Dec. 1961). (HW-SA-2317)

Studies were carried out on the diffusion layers formed in the pressure bonding of Al to Ni-plated U. The bonding conditions were 24,000 psi and 600°C, and the bonding time varied from 5 to 20 min. Optical metallography revealed 2 layers between Al and Ni and 2 layers between Ni and U, which is in agreement with the results of Angerman. Electron microscopy, on the other hand, revealed 3 layers between Al and Ni and 7 layers between Ni and U. Heat treatment resulted in Al penetrating the Ni and forming UAl_3 with U, and there are five layers containing Ni, two of which are the Al_3Ni and Al_3Ni_2 of Angerman's work. (D.L.C.)

6607 BRAZING BERYLLIUM FOR AEROSPACE APPLICATIONS. C. L. Cline and R. A. O'Neill (Lockheed Missiles and Space Co., Sunnyvale, Calif.). Welding J., (N. Y.), 41: 1098-1106(Dec. 1962).

The results are summarized of several research programs directed toward producing beryllium brazements for service temperatures above 1000°F. Several silver base alloys and brazing processes were investigated to

determine the effects of: (a) brazing temperature, (b) time above the Ag–Be eutectic temperature, (c) heating and cooling rates, (d) braze atmosphere and (e) the preferred braze alloy and brazing process. Results indicate that time-temperature relationships have a pronounced effect on the braze if the braze temperature is above the Ag–Be eutectic temperature (1616°F). Extended time periods above this temperature result in an increase in the formation of brittle beryllium intermetallics and porosity in the beryllium adjacent to the braze, decreasing the effective braze strength. The Ag–Cu–Li braze alloy yielded the highest elevated temperature strength. Both the induction process (used in conjunction with slow heating and a purified inert atmosphere) and the cold wall vacuum furnace process are acceptable for high temperature beryllium brazing. (auth)

6608 MACHINING DIFFICULT ALLOYS. A Compendium on the Machining of High-Strength Steels and Heat-Resistant Alloys. Taylor Lyman, ed. Metals Park, Ohio, American Society for Metals, 1962. 379p. (ASD-TR-62-7-634)

Twenty-five chapters are included on the machining rates, costs, and experience with high strength steel and heat-resistant alloys. The emphasis is on the engineering and cost considerations in manufacture of parts and on the solution of production problems. Several digests and abstracts are also given. Separate abstracts were prepared for 18 of the chapters. (D.L.C.)

6609 A COMPARISON OF THE MACHINING CHARACTERISTICS OF TWO HIGH-STRENGTH STEELS AND THREE HEAT-RESISTANT ALLOYS. p.1-24 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

The relative machining characteristics and machining costs for two high-strength steels (4340 and modified 4330) and for three heat-resistant alloys (Inconel X-750, HS-25, and A-286) were evaluated. The alloys tested were in the heat treated condition, and tensile strengths ranged from 136,500 to 277,000 psi. The machinability of these alloys in various operations was compared with that of type 4130 steel at a tensile strength of 100,000 psi. (D.L.C.)

6610 SPEEDS AND FEEDS FOR MAXIMUM ECONOMY IN MACHINING A-286 ALLOY. p.25-34 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

The optimum speeds and feeds for use with A-286 in milling, turning, drilling, reaming, tapping, threading, and band sawing operations were determined. The effects of feed and speed on the cost of machining A-286 are discussed. (D.L.C.)

6611 COMPARATIVE MACHINING TIME AND PRODUCTION RECOMMENDATIONS FOR HASTELLOY X, RENÉ 41 AND HS-25 ALLOYS. W. J. Maxson (Boeing Co., Aero-Space Div., Seattle). p.45-55 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Experience gathered in the production of structural parts of 14 different configurations from Hastelloy X, René 41, and Hs-25 alloys is reported. The machining operations included milling, drilling, lathe operations, and sawing. Recommendations are given for the machining of the three alloys. (D.L.C.)

6612 MILLING HIGH-STRENGTH STEELS AND HEAT-RESISTANT ALLOYS. p.59-84 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

A review is presented of the milling problems related to individual classes of alloys, such as high-strength steels, precipitation-hardening stainless steel, and Ni-base and Ti alloys, with the emphasis on tool life. The effects of tool angles, operating conditions, and coolants or lubricants on tool life are discussed. (D.L.C.)

6613 END MILLING HARDENED RENÉ 41 ALLOY. Carl J. Oxford, Jr. p.85-93 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Tests were conducted to determine rates of wear, evaluate tool materials, and compare deflection in climb milling and conventional milling in the milling of hardened René 41. The results of the tests are described. (D.L.C.)

6614 PERFORMANCE OF SEVERAL HIGH SPEED STEELS IN END MILLING U-500 ALLOY. W. J. Maxson (Boeing Co., Aerospace Div., Seattle). p.103-6 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Tests were conducted to compare end mills made of Co-free and Co-containing high-speed steels in the end milling of U-500 alloy. The test results indicate that U-500 can be end milled with reasonable tool life when either the Co-free or Co-containing steels are used. (D.L.C.)

6615 DRILLING HIGH-STRENGTH STEELS AND HEAT-RESISTANT ALLOYS. p.115-34 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

A review is presented of the variables affecting drilling performance in the machining of high-strength steels and heat-resistant alloys. Case histories and test program results are presented, grouped according to alloy type. (D.L.C.)

6616 DRILLING HARDENED RENÉ 41 ALLOY. Carl J. Oxford, Jr. p.135-43 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Results are reported for tests conducted on drilling of hardened René 41. A comparison of the tool life of five high-speed steels used with hardened René 41 is presented, and observations are given on drill design, torque and thrust, response of work material, deep-hole drilling, and carbide and gun drills. The effects of hardened René 41, annealed René 41, and three other materials on the drill life are compared. (D.L.C.)

6617 DRILLING OF HARDENED ASTROLOY. C. E. Glynn (General Electric Co., Cincinnati). p.145-50 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

A test program was conducted to determine optimum operating conditions and tooling for drilling Astroloy in the solution-treated and aged condition, at Rockwell C 42. The effects of tool material and tool design on performance and tool life were studied. (D.L.C.)

6618 THE DRILLING OF BERYLLIUM. p.151-8 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Tests were conducted to evaluate high-speed steel and carbide tools for drilling beryllium. Tool life was studied. Observations are given on the performance of specific tools, tool life, surface finish, breakout (spalling), and health hazards. (D.L.C.)

6619 MODIFICATIONS OF TOOLING FOR SINGLE-POINT CUTTING OF HEAT-RESISTANT ALLOYS. p.167-78 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Eleven single-point cutting tools are described which

were developed for specific machining operations on heat-resistant alloys. (D.L.C.)

6620 LATHE TURNING OF BERYLLIUM. p.179-88 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

A study was made of the effects of tool design, cut depth, feed, and speed on the rough- and finish-turning of beryllium. Chip formation and surface cracking were studied. The design of a turning tool for beryllium is described. (D.L.C.)

6621 NINETEEN PROBLEMS IN BROACHING HIGH-STRENGTH STEEL AND HEAT-RESISTANT ALLOYS. p.191-209 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Nineteen examples are given of the design of broach tools for high-strength steel and heat-resistant alloys. (D.L.C.)

6622 TOOL DESIGN AND MATERIAL FOR BROACHING HIGH-STRENGTH STEEL AND HEAT-RESISTANT ALLOYS. C. D. Rockwell. p.211-14 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

A revision of the conventional broach design eliminated tooth breakage and increased tool life. The use of the revised broach with type 4340 steel, René 41, titanium alloys, and refractory metals is discussed. (D.L.C.)

6623 TOOLS FOR BROACHING RENÉ 41. G. Jimerson. p.215-25 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Tool design and tool material were evaluated for production broaching of René 41 turbine wheels. The effects of rake angle, clearance, chip load, and tool material on the wear rate and chipping of tools were studied. A holding fixture for turbine wheels is described. (D.L.C.)

6624 INDUSTRIAL EXPERIENCE IN GRINDING HEAT-RESISTANT ALLOYS. p.229-44 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Data and experience are reported for grinding of: hardenable stainless steels, nickel-base alloys, a cobalt-base alloy, titanium alloys, refractory metals and alloys, zirconium, and zirconium alloys. (D.L.C.)

6625 EFFECT OF GRINDING VARIABLES ON THE GRINDING CHARACTERISTICS OF STAINLESS STEELS AND HEAT-RESISTANT ALLOYS. L. P. Tarasov (Norton Co., Worchester, Mass.). p.245-65 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

Surface grinding tests were conducted to study the effect of major processing variables on the grindability of 13 austenitic stainless steels and heat-resistant alloys. The results showed that the type of abrasive and grinding fluid has a large influence on grindability and that traverse speed, downfeed, and crossfeed are of secondary importance. Surface quality is discussed. (D.L.C.)

6626 A HOLD-DOWN FIXTURE FOR GRINDING A THIN RENÉ 41 PART. H. R. Soderstrom. p.275-7 of "Machining Difficult Alloys." Metals Park, Ohio, American Society for Metals, 1962.

A hold-down fixture was designed for grinding a 0.100-in. thick flat part made of René 41 down to 0.080-in. thickness. The fixture utilized a low-melting bismuth-base alloy for fastening the part to a steel support plate. (D.L.C.)

6627 THE JOINING OF RARER METALS. Based on a Symposium at the Borough Polytechnic, London, April, 1961. George Isserlis, ed. Manchester and London, Columbine Press, 1961. 113p.

Six papers are presented on the problems involved in the fabrication of the more important rarer metals. The papers treat respectively electron beam welding; beryllium joining; uranium joining; welding of titanium and its alloys; welding of zirconium alloys; and welding of tantalum, niobium, molybdenum, and tungsten. Separate abstracts were prepared for four of the papers. (D.L.C.)

6628 THE JOINING OF BERYLLIUM. R. W. Atkins (United Kingdom Atomic Energy Authority, Aldermaston, Berks, Eng.). p.14-30 of "The Joining of Rarer Metals." Manchester and London, Columbine Press, 1961.

The difficulties of working Be are described briefly. The development of welding techniques is outlined; d-c welding proved very difficult, but a-c welding gave some control over the welding process. Increasing the welding speed reduced centerline cracking, but transverse cracking persisted in end cap welds. The use of heat to reduce the weld cooling rate, especially in the range 300 to 400°C, enabled crack-free joints to be made. Excellent welds in end cap joints, but not butt joints, could be made in a glass vacuum bell filled with pure Ar. Brazing techniques were investigated, and consumable arc brazing was found to be the most successful method of joining Be. The work on pressure welding of Be is described briefly. (D.L.C.)

6629 THE JOINING OF URANIUM. J. R. Adair (United Kingdom Atomic Energy Authority, Aldermaston, Berks, Eng.). p.31-47 of "The Joining of Rarer Metals." Manchester and London, Columbine Press, 1961.

Uranium can be joined by many commercial welding techniques, provided oxidation is limited and support during welding is provided. Precautions are needed to protect welders from the toxic and radioactive hazards of uranium. Different joining processes for uranium are discussed: arc welding, consumable electrode welding, submerged arc welding, electron beam welding, resistance welding, brazing, and soldering. The physical properties of uranium welds are described. (D.L.C.)

6630 THE WELDING OF ZIRCONIUM AND ZIRCONIUM ALLOYS. J. G. Purchas and H. R. W. Cobb (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). p.64-81 of "The Joining of Rarer Metals." Manchester and London, Columbine Press, 1961.

The corrosion of Zr and Zircaloy-2 by water is discussed briefly. The test program for developing corrosion-resistant welds in Zircaloy-2 is described. It was found that such welds in both light and heavy sections could be made in a chamber initially evacuated to 10^{-4} mm Hg and then filled with 160 mm Hg of argon. (D.L.C.)

6631 WELDING TANTALUM, NIOBIUM, MOLYBDENUM AND TUNGSTEN. F. G. Cox. p.82-102 of "The Joining of Rarer Metals." Manchester and London, Columbine Press, 1961.

Welding problems with Ta and Nb arise from their dissolving action on gases with consequent embrittlement. Argon arc welding and resistance welding can be used for Ta and Nb. Welded Ta heaters and condensers are described. For Mo and W, welding problems are more complex owing to their ductility. The effects of impurities and welding atmosphere on the brittle transition in Mo are shown. Various welding techniques for Mo are discussed, but there is no method for welding Mo for sound ductile joints with the possible exception of electron beam welding for specific applications. Satisfactory brazed joints in Mo can be made, however, and tables of brazing alloys and the shear strengths of the resulting brazed joints are given. Welding of W is more difficult than for Mo, but some brazed joints can be made. (D.L.C.)

6632 SYSTEMS FOR ASSEMBLING TOGETHER TWO PIECES HAVING ANISOTROPIC EXPANSIONS. Roland Roche (to Commissariat a l'Energie Atomique). U. S. Patent 3,068,162. "Priority date May 17, 1957, France."

A system is described for assembling two bars having anisotropic expansions and belonging to two crossed layers included in the moderator structure of a nuclear reactor. The system provides for assembly of the bars so that the initial plays are maintained without any substantial variation thereof. (R.J.S.)

Properties and Structure

Refer also to abstracts 7132 and 7571.

6633 (AD-274831) THERMOELECTRIC MATERIALS. Report No. 6. Final Report, January 1, 1960–September 30, 1961. T. S. Shevlin, Henry E. Wenden, and S. R. Ali Zaidi (Ohio State Univ. Research Foundation, Columbus). Sept. 1961. Contract NObs-78254. 32p.

Difficulty was experienced in containing molten $Na_2O \cdot V_2O_4 \cdot 5V_2O_5$, a highly corrosive fluid. The precision and reproducibility of all results were very low. $Na_2O \cdot V_2O_4 \cdot 5V_2O_5$ has a potential difference of 2500 $\mu v/°C$ as referred to platinum when oxygen is circulated over the hot junction and the cold junction is sealed. When air is circulated over the hot junction and the cold junction is sealed, a maximum potential difference of 700 $\mu v/°C$ may be attained. As the difference in temperature between hot and cold junctions is decreased, the potential difference increases, rising to a maximum near a temperature difference of 40°C. A reducing atmosphere over the hot junction reduces the thermal emf, and, if sufficiently reducing, reverses the polarity; an oxidizing atmosphere raises the emf, as compared with a neutral (He) atmosphere. (auth)

6634 (AFOSR-2273) INVESTIGATION OF SOLID SURFACES BY FIELD EMISSION MICROSCOPY AND MASS SPECTROMETRY. Final Report. Richard C. Bradley (Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics). Mar. 1, 1962. Contract AF49(638)-748. 14p. (AD-276727)

The physics of surface phenomena on metals under ultra-high vacuum conditions or in controlled pure gas atmospheres of argon, xenon, oxygen, and nitrogen were studied. A bakeable mass spectrometer was designed and built specifically for this purpose. An investigation was made of the mechanisms of sputtering, evaporation, and desorption from molybdenum, tantalum, platinum, and copper. Additional information was obtained on electron emission phenomena from zirconium and some of its alloys with the field-emission microscope. (auth)

6635 (AGN-8069) RUBIDIUM/CESIUM EVALUATION PROGRAM. Quarterly Progress Report for the Period June 30 through September 30, 1962. C. R. Fisher and P. Y. Achener (Aerojet-General Nucleonics, San Ramon, Calif.). Oct. 31, 1962. Contract AT(04-3)-368. 60p.

The characteristics of Rb and Cs at temperatures up to about 2000°F are being evaluated. The current program includes studies of the boiling heat transfer and two-phase flow characteristics, and measurements to determine the latent heat of vaporization, density, specific heat, viscosity, thermal conductivity, and electrical resistivity of the liquid phases of these metals. Work performed during the period 30 June through 30 September 1962 is reported. The results of the preliminary test work performed in the heat transfer and fluid flow task and the apparatus to be used to measure latent heat of vaporization, specific heat, and density are described. (auth)

6636 (ANL-FGF-247) US AND ThS BODIES. P. D. Shalek (Argonne National Lab., Ill.). Apr. 6, 1961. Contract [W-31-109-eng-38]. 14p. (UAC-5151)

Uranium monosulfide of 99% purity can be vacuum sintered to 86% theoretical density while ThS of 96.5% purity can be vacuum sintered to 97.5% theoretical density. Solid solutions show intermediate sintering characteristics. Argon sintering produced US bodies of much higher density. The lower compositional limit of the US phase may be as low as $US_{0.96}$. Monosulfide bodies are relatively soft and brittle materials which exhibit the appearance, electric conductivity, and machineability of metals. Their thermal conductivity is expected to be good. Modulus of rupture values for the monosulfides are moderately high. The linear thermal expansion coefficients of US and ThS are almost the same as those of the dioxides. As expected, the monosulfides show poor oxidation resistance but are resistant to boiling water. Stability in H_2 is indicated. The US microstructure shows stacking faults; that of ThS does not. Efforts to eliminate these faults through annealing are indicated since it is believed they adversely affect the properties of the bodies. (auth)

6637 (ANL-FGF-321) PREPARATION AND SOME PROPERTIES OF ARC-CAST PLUTONIUM MONOCARBIDE. O. L. Kruger (Argonne National Lab., Ill.). Feb. 5, 1962. Contract [W-31-109-eng-38]. 22p. (UAC-6095)

Plutonium–carbon alloys in the compositional range of 42 to 60 at. % Ca were prepared by arc melting and drop casting. Metallography, x-ray diffraction, and chemical analysis were used to evaluate the alloys. Density, hardness, and thermal expansion were measured. Unexpected abrupt changes in the rate of expansion, which could not be attributed to a phase change, were observed in alloys with more than 46 at. % Ca. This effect, which accounted for increases of two to four times the normal thermal expansion coefficient, was removed on thermal cycling. (auth)

6638 (ANL-FGF-343) PHASE STUDIES ON ARC-MELTED PLUTONIUM–CARBON ALLOYS NEAR THE MONOCARBIDE COMPOSITION. Owen L. Kruger (Argonne National Lab., Ill.). Apr. 23, 1962. Contract [W-31-109-eng-38]. 25p. (YAC-6361)

The phase boundaries of plutonium monocarbide were studied. Arc-melting of the elements using non-consumable electrodes was selected as the best method of preparing pure, dense alloys in the range of composition 42 to 60 at. % C. Chemical, metallographic, and x-ray examination of the arc-melted alloys showed that single phase PuC and Pu_2C_3 of low impurity content could be made by this method. A primary Pu_2C_3 phase was present in alloys containing more than 46 at. % C as determined by metallographic and x-ray diffraction techniques. Comparison of the theoretical and experimental densities of these Pu–C alloys showed that PuC is a defect structure with some of its C atom lattice sites vacated in alloys with less than 50 at. % C. The phase boundaries of cast PuC were found to be about 42.5 at. % C on the low-C side to between 48.5 and 50 at. % C on its high-C side. (auth)

6639 (ASD-TDR-62-230) DETERMINATION OF ENGINEERING PROPERTIES OF MAR-STRAINED STEELS. R. E. Yount (General Electric Co., Evendale, Ohio). Jan. 1962. Contract AF33(616)-7655. 145p.

The Mar-Strain response (the addition of strain and aging to quenched and tempered steels) was determined for eight alloys representing four classes of steel: low alloy martensitics, secondary hardening martensitics (hot work

die steels), semi-austenitic, and martensitic stainless. All four alloy classes responded to the process by demonstrating yield strength increases of 10 to 20%. It was found that the tempered structure and strain hardening characteristics were the most significant factors controlling the Mar-Strain response. The alloys were selected for determination of their engineering properties including uniaxial tensile, fatigue and center notch properties, and biaxial performance in sub-scale cylinder tests. One alloy, Ladish D6AC (0.46% C–1% Cr–1% Mo), was capable of being Mar-Strained to a 275,000 psi 0.2% yield strength. A second alloy, Modified S-5 (0.48% C–2% Si–5% Mo–0.25% V), was capable of being Mar-Strained to a 300,000 psi 0.2% yield strength. Mar-Straining was found to increase the fatigue strength of both alloys. The process was adequately demonstrated in the sub-scale pressure vessel tests. Burst strengths (greater than 350,000 psi hoop) achieved with the Mar-Strained S-5 cylinders were higher than any previously reported for a homogeneous material. (auth)

6640 (ASD-TDR-62-608(Pt.I)) THERMAL CONDUCTIVITY OF ANISOTROPIC SOLIDS AT HIGH TEMPERATURES. THE THERMAL CONDUCTIVITY OF MOLDED AND PYROLYTIC GRAPHITES. PART I. Michael Hoch and Joseph Vardi (Cincinnati. Univ.). June 8, 1962. Contract AF33(616)-7123. 19p.

A method was developed for the determination of the thermal conductivities of anisotropic solids under conditions of two-dimensional, steady-state heat conduction in a cylinder of finite length heated in vacuum by high frequency induction and radiating heat to the surroundings. The method was used to determine the radial thermal conductivity, k_r, and the axial thermal conductivity, k_z, of molded ZT-type and pyrolytic graphite in the temperature range 1200 to 2200°K. For ZT-type graphite $k_z/k_r = -0.10116 + 2.00191 \times 10^{-4} \times T$ (1260°K < T < 2199°K); for pyrolytic graphite, $k_z/k_r = 0.0376$ at 1817°K. (auth)

6641 (AWRE-0-59/62) ELECTRON MICROSCOPE STUDIES OF BERYLLIUM. V. D. Scott (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Oct. 1962. 55p.

A number of electron microscopy techniques for studying problems associated with the plastic behavior of Be are described. An attempt is made to explain the microstructures observed in terms of the mechanical properties of the metal. Theories put forward to explain the brittle behavior of Be at 600°C are also discussed and an alternative mechanism is proposed which involves a consideration of the value of the stacking fault energy of the material. (auth)

6642 (AWRE-0-63/62) A COMPARISON OF THE EFFECTS OF MACHINING AND GRINDING ON THE TENSILE PROPERTIES OF BERYLLIUM. F. Morrow and A. Moore (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Research Establishment, Harwell, Berks, England). Nov. 1962. 16p.

Tensile specimens were prepared from hot-extruded ingot Be rod by turning and grinding, and the specimens were tested at temperatures between 20 and 600°C. It was found that the specimens exhibited the same mechanical behavior when prepared by grinding as those which had been produced by turning. (auth)

6643 (BBC-112) DEVELOPMENT OF INTERMETALLIC COMPOUNDS FOR VERY HIGH TEMPERATURE APPLICATIONS. Quarterly Progress Report, July 1, 1961–September 30, 1961. R. M. Paine, E. Bourguignon, A. J. Stonehouse, and W. W. Beaver (Brush Beryllium Co., Cleveland). Nov. 10, 1961. Contract AT(33-3)-20. 38p.

Studies aimed at determining the extent and mechanism of the intermediate temperature problem associated with certain Zr beryllides are discussed. The problem has generally manifested itself as poor oxidation resistance, strength, and thermal shock resistance at intermediate temperatures. The results of testing numerous beryllide compositions at various temperatures between 1200 and 1800°F show that the poor oxidation resistance of $ZrBe_{13}$ most often manifests itself between 1300 and 1600°F. Certain additives such as Al, Fe, and Ni improve the oxidation resistance at some temperatures and, as a result, the problem is limited to a narrower temperature range. $ZrBe_{13}$ pressings which were essentially single-phase showed the best resistance, while pressings containing large amounts of two phases showed catastrophic oxidation even at 1200 and 1700°F. Specimens cut from certain early preparations of $ZrBe_{13}$ and (U, Zr)Be_{13}–10 wt % U pressings exhibited excellent oxidation resistance after successive 100-hr periods at 1500, 1400, and 1300°F in laboratory air. Preliminary examination of cast Zr and Nb beryllides has shown that these also show accelerated oxidation at the intermediate temperatures. Metallographic examination of partially oxidized $ZrBe_{13}$ specimens shows that certain Zr_2Be_{17} grains in the $ZrBe_{13}$ matrix are selectively attacked, causing local stresses and microcracking. (auth)

6644 (BLG-132) LA STRUCTURE MOSAÏQUE ET SA DETERMINATION. (The Mosaic Structure and its Determination). H. Pollak (Brussels. Centre d'Étude de l'Energie Nucléaire). June 1957. 40p.

By means of x-rays, the mosaic structure can be measured only in a thin region of a crystal in the neighborhood of its surface. As a consequence of the small absorption coefficient of neutrons, neutron diffraction can be used to explore the mosaic structure of the whole crystal, even in the case of thick crystals. In the case of neutron diffraction, measurements are made either by divergency or by reflectivity. The latter method is presented and appears to be both simple and accurate. (R.J.S.)

6645 (BMI-1604) FISSION-PRODUCT-RELEASE MEASUREMENT FROM CLAD FUEL SPECIMENS. Mihkel Kangilaski, Arthur A. Bauer, Frank A. Rough, and Ronald F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Nov. 28, 1962. Contract W-7405-eng-92. 20p.

Xe^{133}, Xe^{135}, Kr^{85m}, Kr^{87}, I^{131}, I^{133}, and I^{135} release from UO_2 fuel specimens with four types of metallic claddings was determined during irradiation in 2200 to 3200°F flowing helium and oxygen. Fission-gas samples cold trapped from the furnace sweep gas were identified in a gamma analyzer. Information on iodine release was obtained by monitoring xenon produced by iodine decay after irradiation and by washing and scrubbing the loop after irradiation to recover iodine plated out in the system. Uranium contamination of portions of the loop made it impossible to detect releases below a certain level from the specimens. Specimens clad with niobium or niobium-29.6 wt % aluminum-33.7 wt % titanium exhibited release fractions in the range of 10^{-6} at 2200°F and 10^{-5} at 3000 and 3200°F. Release values for iron-30 wt % chromium-1 wt % yttrium-clad material at 2200°F were aroung 2×10^{-2}. Material clad with iron-25 wt % chromium-1 wt % yttrium-4.67 wt % aluminum exhibited a release fraction of 1.6×10^{-3} during irradiation in 2200°F oxygen and oxygen saturated with water vapor. (auth)

6646 (BNL-5674) SPIN DENSITY DISTRIBUTIONS AND HARTREE-FOCK CALCULATIONS FOR THE IRON

GROUP SERIES. Robert Nathans (Brookhaven National Lab., Upton, N. Y.); Stanley J. Pickart, and Harvey A. Alperin (Naval Ordnance Lab., White Oak, Md.; and Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT-30-2-GEN-16]. 13p.

The available data on neutron form factors for the iron group series were assembled and compared with the Hartree-Fock calculations for the free atoms. For the metals the data indicate a significant contraction in the unpaired electron distribution relative to the total 3d group. These differences are consistent with recent band calculations on iron which predict d-electron wave functions, significantly more contracted at the top of the band than at the bottom. For the non-metals, the magnetic electron distributions are characterized by a more expanded distribution for $Mn^{2+}(3d^5)$ and $Fe^{3+}(3d^5)$ relative to the free atom, and a more contracted distribution for $Ni^{2+}(3d^8)$. The changes in the self-energies of the d electrons produced by these shifts, as estimated from Watson's tables, are appreciable. A review of theoretical discussions on the changes in the free atom configuration caused by the inclusion of the ions in a solid gave no clues to the differences between the $3d^5$ and $3d^8$ groups. The possibility of errors in the free atom self-consistent field calculations for the outer electron wave functions is discussed. (auth)

6647 (BNL-5747) NEUTRON DIFFRACTION STUDIES OF FERROELECTRICS. B. C. Frazer (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT-30-2-GEN-16]. 19p.

Neutrons were used to somewhat greater advantage than x rays in determining ferroelectric structures. This was mostly because so many ferroelectrics contain light atoms in the presence of relatively heavy ones. Two of the most important ferroelectrics, $BaTiO_3$ and Rochelle salt, are discussed as examples. In both cases it seems that x-ray solutions are not feasible. It was possible to obtain a neutron solution for the $BaTiO_3$ structure, but because of the pseudosymmetric nature of the structure this turned out to be a difficult problem. The outlook for a detailed solution of the ferroelectric structure of Rochelle salt is not very hopeful; however, some useful results were obtained. An interesting by-product of the neutron study of this crystal was the discovery that irradiation by x rays and γ rays produces serious microstructural changes. Previously the effects of radiation on Rochelle salt were ascribed entirely to macroscopic changes. (auth)

6648 (CEA-2129) CONTRIBUTION A L'ÉTUDE DE LA STRUCTURE ET DES PROPRIÉTÉS DES GELS DE SILICE. (Contribution to the Study of the Structure and Properties of Silica Gel). Jacques Fraissard (France. Commissariat à l'Energie Atomique. Centre d'Études Nucléaires, Saclay). 1962. 117p.

Thesis submitted to Paris. Université.

Study of the texture of two types of silica gels, the xerogels and the aerogels, shows that the latter evolve differently on heating. This is due to a microstructure which depends upon the preparation conditions. The state of the water of composition of these gels has been determined. A mechanism has been proposed for the adsorption of formic acid on two types of gel, thereby explaining the differences in specificity of the two solids in the decomposition reaction of the acid. (R.J.S.)

6649 (DC-61-7-26) DEVELOPMENT OF HYDRIDING PROCEDURES THEORY AND APPLICATION. W. M. McCain (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). July 14, 1961. Contract AT (11-1)-171. 33p.

Some aspects of the theory of massive hydriding of zirconium are covered. The processing steps, the introduction of isochores as a tool to uniform hydrogen distribution, and a suggested modification of a H-Zr phase diagram are discussed. (auth)

6650 (DMIC-177(Vol.I)) THERMAL RADIATIVE PROPERTIES OF SELECTED MATERIALS. W. D. Wood, H. W. Deem, and C. F. Lucks (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Nov. 15, 1962. 194p.

Data on thermal radiative properties are compiled. A brief discussion is included of the basic fundamentals of thermal radiation and of the methods of measuring these properties. Much of the information has previously been distributed; however, it is consolidated here for the benefit of those with a broad interest in radiant heat transfer. Thermal radiative data are included for the following materials: Ti and its alloys; stainless steels; Fe-, Ni-, and Co-base superalloys; and the refractory metals (Cr, Mo, Nb, Ta, and W) and their alloys. (R.J.S.)

6651 (DMIC-178) STEELS FOR LARGE SOLID-PROPELLANT ROCKET-MOTOR CASES. J. E. Campbell (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Nov. 20, 1962. 32p.

Several alloy steels that have high strength have come into use in large solid-propellant rocket-motor cases. Of particular interest for current rocket-case applications are AISI 4340, AMS 6434 (modified), Ladish D-6ac, and H-11 hot-work tool steel. Experience has indicated that AISI 4340 steel, fabricated by rolling and welding and heat treated to 260,000 to 280,000 psi tensile strength, is entirely satisfactory for the first and second stages of the Nike Zeus missile. Modified AMS 6434 steel has been specified for the first and second stages of the A-1 Polaris and for the first stage of the A-2 Polaris missiles. In making first-stage Minuteman cases, D-6ac steel, which is a consumable-electrode arc vacuum-melted version of Ladish D-6a steel, has been used. Cases for the first and second stages of the Pershing missile have been made of H-11 steel. Treatments and properties of these and other alloy steels that are being used or considered for rocket-motor cases are discussed. (R.J.S.)

6652 (DRI-2057) DETERMINATION OF THE NIOBIUM-RICH REGION OF THE TERNARY PHASE DIAGRAMS, NIOBIUM–TUNGSTEN–HAFNIUM AND NIOBIUM–TUNGSTEN–ZIRCONIUM. Quarterly Progress Report No. 1, June 1, 1962–August 31, 1962. Albert S. Yamamoto and Charles E. Lundin (Denver. Univ. Denver Research Inst.). Sept. 1, 1962. Contract AT(11-1)-1092. 6p.

High-temperature furnaces for heat treatment of alloy samples in high vacuum are briefly described. Source and preparation of materials and alloys are noted. Niobium–aluminum–zirconium alloys were prepared. (R.J.S.)

6653 (DRI-2071) INTERMEDIATE-TEMPERATURE OXIDATION OF BERYLLIDES. Quarterly Progress Report, September 1 to December 1, 1962. Frank C. Perkins (Denver. Univ. Denver Research Inst.). Dec. 10, 1962. Contract AT(11-1)-1092. 25p.

The oxidation kinetics and characteristics of $ZrBe_{13}$, Zr_2Be_{17}, $NbBe_{12}$, and Nb_2Be_{17} in the temperature range 1200 to 1800°F are discussed. The beryllides under consideration are subject to catastrophic oxidation and/or disintegration when exposed to oxidizing atmospheres at these temperatures. The principal techniques employed in the investigation have included metallography, x-ray

diffraction, and thermogravimetric measurements under different atmospheres. (auth)

6654 (EURAEC-394) ZIRCONIUM AND ALLOYS. Quarterly Report No. 1, April 1, 1962–June 30, 1962. (Compagnie Pechiney, Paris). July 19, 1962. Work performed under United States–Euratom Joint Research and Development Program. 16p.

The effects of extrusion on the structure of Zr, V–Zr alloys, and Zr_2Ni are briefly reported. (R.J.S.)

6655 (GA-3067) EVALUATION OF $(Th,U)C_2$, CARBON-COATED $(Th,U)C_2$ PARTICLES, AND CARBON COATINGS. G. B. Engle, C. S. Luby, and J. C. Bokros (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Apr. 26, 1962. Contract AT(04-3)-314. 41p.

Thorium and uranium carbide nuclear fuel particles were evaluated by metallographic and x-ray diffraction techniques. Techniques were developed to etch the polished surface of Th–U carbide to reveal the grain structure. In addition, techniques to determine particle density and coating thickness were developed. Comparison of the data indicates that the use of spherical particles allowed for more precise determination of the coating thickness, density, and strength of coatings. Strength of individual particles was about 700 to 1300 g per particle. A large scatter in crushing-strength values was observed when individual particles were crushed. Consequently, a relative crushing-strength test was developed for comparing coating strength: loads were applied to a column of particles in stepped increments, and broken coatings were detected by observing a weight gain in moist air from hydrolysis of the Th–U carbides. A correlation of relative crushing strength and coating thickness was obtained. The crystal structure of the C coatings was found to depend on the temperature of deposition in the range from 1400 to 2400°C; the two-dimensional structure became more defined with increasing deposition temperatures. Subsequent annealing at 2400°C of the coatings deposited at 1400°C and at 2200 to 2400°C produced graphitization, whereas those deposited at 1800 to 2000°C retained their two-dimensional character. Macrostructure of the coatings as revealed by metallographic techniques showed a concentric shell-like structure in the 1400°C deposits and mottled or conical structure in the 1800°C deposits. Annealing to higher temperatures did not alter the general appearance of either macrostructure. (auth)

6656 (HW-75501) ELECTRICAL PROPERTIES OF ZrO_2 CORROSION FILMS. ELECTRICAL RESISTANCE MEASUREMENTS. Interim Report No. 1. D. W. Shannon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 1962. Contract [AT(45-1)-1350]. 18p.

Measurements have been made of the electric resistance of ZrO_2 corrosion films on Zircaloy-2 and crystal bar Zr as a function of variables such as gas atmosphere, radiation, heat treatment, and temperature. It has been found that the electric resistance of the corrosion film decreases from the meg-ohm region to as low as 10 ohms when the gas atmosphere is made nonoxidizing. It also was found that a log resistance versus 1/temperature plot yields a fairly straight line allowing an "activation energy" to be calculated. A theory is presented which suggests a lower electric resistance for the corrosion film may be used to lower corrosion hydrogen absorption. The effect of in-reactor radiation was to lower the ZrO_2 film resistance by a factor of 600. (auth)

6657 (HW-SA-2550) ELECTRON MICROSCOPY LABORATORY. J. L. Daniel (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 24, 1962. Contract [AT(45-1)-1350]. 9p.

This laboratory performs detailed studies of the properties and behavior of high temperature reactor fuel materials, particularly as affected by radiation. Reflection electron microscopy is employed for the examination of single crystals of uranium dioxide. (R.J.S.)

6658 (IS-433) ELECTRICAL PROPERTIES OF THE TUNGSTEN BRONZES. H. R. Shanks, P. H. Sidles, and G. C. Danielson (Ames Lab., Ames, Iowa). [Mar. 8, 1962]. Contract [W-7405-eng-82]. 18p.

The electric resistivity of Na_xWO_3, Li_xWO_3, and K_xWO_3 has been measured at 300°K. The range of x-values was $0.25 < x < 0.9$. All resistivities were characteristic of a metal and lie on a single curve. An extrapolation of the conductivity curve to zero conductivity indicated that the tungsten bronzes should be semiconductors for $x < 0.25$. The resistivities that have been measured for tungsten bronzes with $x < 0.25$ showed semiconducting behavior. The resistivity of Li_xWO_3 exhibited an anomalous peak in the ρ vs T curve. The Hall coefficient of $Li_{0.37}WO_3$ indicated one free electron per alkali atom as was previously found for Na_xWO_3. The Seebeck coefficient of Na_xWO_3 depended linearly on $x^{-\frac{1}{3}}$ as expected from free electron theory. The implications of these and some other data are discussed. (auth)

6659 (IS-442) THORIUM–MOLYBDENUM PHASE DIAGRAM. O. D. McMasters, P. E. Palmer, and W. L. Larsen (Ames Lab., Ames, Iowa). [Mar. 27, 1962]. Contract [W-7405-eng-82]. 16p.

The phase diagram of the Th–Mo alloy system has been determined to be of the eutectic type with a eutectoid reaction associated with the Th alpha-beta transformation. X-ray, thermal, electric resistance, and metallographic methods have established the eutectic point at 1380 ± 10°C and 7.0 ± 0.5 wt % Mo. A eutectoid reaction is proposed at 1358 ± 5°C and less than 0.1 wt % Mo. No solubility of Th in Mo was detected at 1325°C. (auth)

6660 (IS-462) THE ADSORPTION AND SURFACE REACTIONS OF HYDROCARBONS ON CLEAN IRIDIUM. John R. Arthur, Jr. (Bell Telephone Labs., Inc., Murray Hill, N. J.) and Robert S. Hansen (Ames Lab., Ames, Iowa). [Apr. 7, 1962]. Contract [W-7405-eng-82]. 22p.

The adsorption of ethane, ethylene, and acetylene on clean iridium in a field emission microscope was found to cause characteristic changes in the work function of the iridium surface. Further changes, which were time and temperature dependent, resulted when such surfaces were heated. Flash filament experiments showed that the changes in work function upon heating are due to desorption reactions and that the desorbed product consists principally of hydrogen. By assuming a linear relationship between surface coverage and work function, it was possible to determine the desorption kinetics from the observed rates of work function change at various temperatures. The results were consistent with a mechanism involving stepwise surface dehydrogenation in which a pair of hydrogen atoms is removed from the hydrocarbon molecule in each step, followed by desorption of the adsorbed hydrogen. At very high temperatures the remaining carbon atoms are removed, presumably by evaporation. (auth)

6661 (JPL-TR-32-222) TENSILE PROPERTIES OF FIVE LOW-ALLOY AND STAINLESS STEELS UNDER HIGH-HEATING-RATE AND CONSTANT-TEMPERATURE CONDITIONS. W. W. Gerberich, H. E. Martens, and R. A.

Boundy (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). June 1, 1962. Contract NAS 7-100. 47p.

High-heating-rate results were obtained for three low-alloy steels: 4340 (400°F temper), 4130 (800°F temper), and 4130 (1050°F temper) and two stainless steels: 17-7 PH (TH 1050) and 410 (700°F temper). Stress levels ranging from 10 to 125 ksi and heating rates varying from 40 to 2000°F/sec were the testing parameters. A method is devised to compare yield temperature data of high-heating-rate tests to tensile yield data of steady-state elevated temperature tests. Results indicate that high-heating-rate properties of all the materials are superior to steady-state elevated-temperature properties for heating rates of 40 to 2000°F/sec. For the low alloy steels, the higher the tempering temperature, the better the high-heating-rate properties. Properties of 410 stainless steel are superior to those of all other materials investigated. (auth)

6662 (LA-2768) THE THERMAL EXPANSION OF PuC AND PuC–UC SOLID SOLUTION. A. E. Ogard, C. C. Land, and J. A. Leary (Los Alamos Scientific Lab., N. Mex.). Oct. 1962. Contract W-7405-eng-36. 21p.

Thermal expansion characteristics for arc melted Pu–C alloys containing 41.1, 43.2, 44.9, 45.4, 45.8 at.% C and $U_{0.87}Pu_{0.13}C$ have been determined between room temperature and 900°C. The average coefficients of linear thermal expansion for single phase alloys containing 45.8 at.% C and $U_{0.87}Pu_{0.13}C$ are presented, as well as results pertaining to the Pu–C phase diagram. A mechanism is suggested to explain the unusual contraction that was observed in the dilatometric curves for the 43.2 to 45.4 at.% C alloys. (auth)

6663 (MATT-154) LOW CYCLE TENSILE FATIGUE TESTS OF 305 STAINLESS STEEL. Robert Mark (Princeton Univ., N. J. Palmer Physical Lab.). Nov. 1962. Contract AT(30-1)-1238. 10p.

A series of pull-pull cyclic loading tests of type 305 stainless steel specimens to determine a number of cycles to failure vs stress level curve for application in the design of high magnetic field research devices are described. The effect of surface finish was investigated with specimens having several different common machined finishes. The test results indicate that the material will not rupture under any practical number of cycles of tension loading with stress levels at or below the 0.2% offset yield point. For structures subjected to between 10^5 and 10^6 loading cycles, rupture should not occur below the stress level given by $\sigma_L = 17.5 \log (10^8/N)$; where σ_L = limiting stress level (ksi), and N = maximum number of load cycles. (auth)

6664 (MND-M-2346) INVESTIGATION OF STABILIZED AND HYDRATION RESISTANT EUROPIUM OXIDE. W. Precht and H. Barr (Martin Co. Nuclear Div., Baltimore). June 1960. Contract AT(30-1)-2345. 19p.

A stabilized, hydration-resistant form of europium oxide can be achieved through the use of various oxide additions. Although Eu_2O_3 compounded with SnO_2 and Fe_2O_3 shows limited stability, the addition of TiO_2 has proven superior for use as a cermet addition to be heat treated in a reducing atmosphere. Various additions of TiO_2 to Eu_2O_3 ranging from a 1:1 to a 1:2 mol ratio show stabilizing effects, with the high additions of TiO_2 showing greater stability. The use of cermet cores of high ceramic content (42.6 wt %, which is equivalent to 50 vol %) can be fabricated through normal hot rolling procedures. The addition of a flame spray coating on the larger surfaces of the core provides improved bonding. Control blade coupons, utilizing the stabilized Eu_2O_3, have been fabricated, defected to expose the meat, and autoclaved for a total of 284 hr at 640°F and a 2000 psi with no swelling, deformation, or appreciable weight change. (auth)

6665 (NAA-SR-7482) OXIDATION OF URANIUM CARBIDE BY CARBON DIOXIDE. E. W. Murbach and W. D. Turner (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Dec. 30, 1962. Contract AT(11-1)-Gen-8. 19p.

The oxidation of UC by CO_2 has been investigated as a possible first step in a low-decontamination cycle. "Reactive" UC begins to react with CO_2 at about 350°C. Between 375 and 500°C, the activation energy for the reaction was determined to be 25 kcal. At about 525°C, ignition occurs. Below about 670°C, the reaction is: $UC + 2\ CO_2 \rightarrow UO_2 + 2\ CO + C$. Above about 670°C, free C is also removed; however, only 30% of the C is oxidized at the completion of the UC oxidation. Between 375 and 500°C, the oxidation reaction can be formally represented by a first order rate equation. At 450°C, the reaction is approximately proportional to the 0.7 power of the CO_2 pressure from 10 to 600 mm. Freshly arc-melted UC does not react appreciably with CO_2 at temperatures up to 600°C. However, exposure to air, saturated with water at room temperature, converts UC to the reactive state. The oxidized product, which is over 95% −400 mesh, should be suitable for carbothermic reduction without further size reduction. (auth)

6666 (NAA-SR-7637) RAPID OXYGEN DIFFUSION IN BeO. S. B. Austerman and R. A. Meyer (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Nov. 30, 1962. Contract AT(11-1)-Gen-8. 14p.

Previous data on oxygen diffusion in polycrystalline BeO showed two separable regions of diffusion kinetics, and also indicated a third region of very deep, but low-magnitude, penetration by diffusant O^{18}. This deep penetration is verified, and is regarded as being due to a rapid diffusion process. In addition, there appears to be a slight, but detectable, intrusion of H_2O^{18} vapor into grain boundaries at a particular stage of sample preparation. (auth)

6667 (NASA-TN-D-1595) DETERIORATION OF CALCIA-STABILIZED ZIRCONIA (thesis). John D. Buckley (National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.). June 1961. 21p.

Submitted to Clemson Agricultural College, Clemson, S. C.

The possible causes of the physical breakdown and friability exhibited by fused stabilized zirconia refractories when subjected to severe cyclic heat treatment in the heat exchangers of ceramic-heated blowdown jets were investigated. The crystal structure and the calcia content of unused stabilized zirconia refractory and of the deteriorated material were analyzed by x radiation. Results of the analysis showed that the deteriorated material was definitely less stable (contained less cubic zirconia) than unused stabilized zirconia. (auth)

6668 (NMI-9246) REFRACTORY METALS PHASE DIAGRAMS. Quarterly Progress Report, July 1, 1962 to September 1, 1962. E. J. Rapperport (Nuclear Metals, Inc., Concord, Mass.). Jan. 7, 1963. Contract AF33(616)-7157. 19p.

Alloys of Mo–Ti–Zr prepared by powder metallurgy techniques were affected by gross segregation. Solidus and lattice parameter measurements were made in Ta–W–Zr alloys. Tentative diagrams were completed for Ir–Mo and Nb–Ru alloys. Pd–W alloys were prepared by sintering to avoid volatilization of Pd. Preliminary phase diagrams were developed for the alloys Nb–Rh, Ir–Nb, Hf–Nb, and Mo–Os–W. (R.J.S.)

6669 (NP-12295) MECHANISMS OPERATING IN METALS AT ELEVATED TEMPERATURES. Proceedings of the Eighth Sagamore Ordnance Materials Research Conference, Racquette Lake, New York, August 22-25, 1961. (Syracuse Univ., N. Y.). Contract DA-30-069-ORD-3298. 213p.

An up-to-date review of the structural aspects of metals is presented with special reference to the behavior of metals at elevated temperatures. The properties of metals at elevated temperature may also be classified as structure sensitive and structure insensitive properties. Among the latter are the thermal expansion, the electrical and thermal conductivity, the compressibility, and the specific heat. Relatively simple assumptions concerning the make-up of a solid lead to good agreement between theory and experiment. After a brief review of the ideal crystals structure and its consequences with respect to properties, the classes of lattice defects with respect to their geometrical order are discussed as are the various interactions between these defects and their motion under external and internal forces. Microscopically observed deformation characteristics are explained in terms of the motion and interaction of these defects. Modern experimental techniques yielding some direct evidence of the existence of the various defects postulated are briefly reviewed. The modes of failure of metals at elevated temperatures are discussed in terms of evaporation, creep, and fracture. (auth)

6670 (NP-12350) PROGRESS REPORT NO. 16 [ON PROPERTIES OF CARBONS AND GRAPHITES], AUGUST 1, 1962–OCTOBER 31, 1962. J. F. Andrew, N. Juul, S. Sato, H. E. Strauss, and T. Tsuzuku (New York. State Univ., Buffalo). Nov. 15, 1962. Contract AF33(616)-7791. 29p.

Elastic properties of carbons and graphites at room and at high temperature in relation to some of the fabrication and structural variables are discussed. The heat conduction and the heat diffusivity of graphites at high temperature were investigated. The results of measurements of Young's Modulus at room temperature for a raw coke carbon (SF-SB) as function of heat-treatment temperature are reported. Using the improved apparatus, the temperature dependence of the Young's Modulus was reinvestigated from baked to graphitized state for three kinds of carbons (SF-SB, SF-HB, and HF-SB) and for 2200 heat-treated pyrolytic graphite as well as for ZTA graphite in various directions. A study of mechanical energy losses and of the resonance frequency (elastic modulus) at low temperature (down to liquid hydrogen temperature) have led to a discovery of anomalous temperature dependence. In polycrystalline graphite, a Bordoni-type peak in internal friction was found at 50°K. With decrease of temperature the elastic modulus increases for all carbons, thus giving a minimum somewhere around room temperature or above. The temperature dependence of the thermal conductivity and electric resistivity was reinvestigated for a SF-HB carbon heat treated to 1200°, 1500°, and 1800°C. Finally, exhaustive studies were performed with the "steady" sinusoidal heat flow method in order to increase the accuracy of the results and pin down the factors responsible for the scatter of the data. The thermal diffusivity was investigated for a commercial graphite (SC) in the temperature range 60 to 1230°C. (auth)

6671 (NP-12366) THE VISCOSITY OF SATURATED LIQUID POTASSIUM FROM 70 TO 1150 C BY THE OSCILLATING-CYLINDER METHOD. Elton H. Hall and John M. Blocher, Jr. (Battelle Memorial Inst., Columbus, Ohio). Aug. 31, 1962. Contract NAS-5-584. 26p.

An oscillating-cylinder viscometer has been designed and constructed that is suitable for the measurement of the viscosity of liquids, particularly liquid metals, over an extended range of temperature. The apparatus has been used to measure the viscosity of liquid K from 70 to 1150°C, the previous upper limit having been 700°C. The maximum error is estimated to be about 5% and the probable error is thought to be not greater than 2.5%. The reported data for the viscosity of liquid K obey the Andrade equation up to 370°C. Above this temperature deviations occur that may indicate a basic change in the mechanism of momentum transfer in liquid K at that point. (auth)

6672 (NP-12383) ARC-CAST MOLYBDENUM- AND TUNGSTEN-BASE ALLOYS (1960-1961). M. Semchyshen, R. Q. Barr, and E. Kalns (Climax Molybdenum Co. of Michigan, Detroit). Nov. 1962. Contract Nonr-2390(00). 148p.

Progress of work to explain the strengthening mechanisms operative in several Mo-base alloys is described. The optimum contents for conventionally processed Mo-base alloys containing Ti, Hf, Zr, and Ti + Zr are defined. The possibilities of increasing the strengths and reducing the optimum C content of these materials through solution and aging heat treatments are discussed. Attempts to prepare wrought sections of Mo-base alloys containing nominally 10% Nb and/or 10% Ta were only marginally successful owing to difficulties encountered in working the vacuum/arc-cast ingots. A series of experiments is described wherein various melting and deoxidation practices are evaluated in connection with the 50% Mo–50% W alloy. Alloys based on W or on various Mo–W ratios have received considerable attention. Considerable difficulty was encountered in converting certain of the alloys of this type to bar stock. Outstanding elevated-temperature tensile and stress-rupture properties are reported for a number of the compositions that were successfully converted to wrought stock. (auth)

6673 (ORNL-2065) HIGH-THERMAL-CONDUCTIVITY FIN MATERIAL FOR RADIATORS. Period covered: November 1952–August 1954. H. Inouye (Oak Ridge National Lab., Tenn.). Jan. 24, 1957. Contract W-7405-eng-26. 20p.

A study was made to develop heat-resistant fin materials possessing a high thermal conductivity for air radiators. Since an economical and commercially feasible product was desired, the investigation was restricted primarily to a study of electroplated copper, clad copper, and copper alloys. Sheet material 0.008 to 0.010 in. thick was evaluated for fabricability and for metallurgical stability and thermal conductivity at 1500°F. From the results of the tests it was concluded that: electroplates were unsatisfactory; clad-copper fins possessing a thermal conductivity of 50% of that of copper are commercially feasible; and copper–aluminum alloys possessing a thermal conductivity approaching that of copper at 1500°F are possible. Service tests of clad copper and the copper–aluminum alloys indicate that the choice of materials will be dictated by the requirements of the radiator. (auth)

6674 (ORNL-TM-405) THERMAL FATIGUE—AN ANALYSIS OF THE EXPERIMENTAL METHOD. A. E. Carden (Oak Ridge National Lab., Tenn.). Jan. 4, 1963. Contract W-7405-eng-26. 64p.

An analysis of the conventional (Coffin-type) thermal-fatigue test is presented by describing an analytical model from which three methods for determining the plastic-strain range are derived. One of the methods for calculating the plastic strain does not require the knowledge or use of the thermal coefficient, modulus of elasticity, or stress range. The accuracy of this method is not affected

by the variation of the thermal coefficient, modulus of elasticity, or yield strength during the heating and cooling periods. Plastic strains resulting from yielding and relaxation may be accounted for by this method. The errors of conventional methods are discussed. A method for plotting the stress-strain hysteresis loop is also given. From an analysis of the load-temperature loop, it is clearly shown how all of the significant variables can be determined without plotting a stress-strain hysteresis loop. The plastic-strain range, the mechanical-strain range (elastic plus plastic), the stress range, and the plastic-strain energy per cycle can easily be determined from the load-temperature loop. An alternate test is suggested that minimizes all of the major difficulties of the conventional test. An improved test specimen for the conventional test is also recommended. (auth)

6675 (PWA-2128) DETERMINATION OF THE EMISSIVITY OF MATERIALS. Quarterly Progress Report, July 1–September 30, 1962. W. H. Askwyth and R. J. Hayes (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Contract NASw-104. 96p.

Work was continued in support of NASA space power systems. An aluminum phosphate-bonded mixture of nickel-chrome spinel and silicon dioxide completed 8650 hr of endurance testing on a SNAP-8 finned-tube radiator segment. Flame-sprayed coatings of titania on SNAP-8 and Sunflower I sections completed 7810 hr and 7760 hr, respectively. A fourth rig containing a SNAP-8 section with an aluminum phosphate-bonded mixture of silicon carbide and silicon dioxide completed 6530 hr of testing. Emittance measurements were made on ten materials and on the substrate material, niobium-1% zirconium alloy. The ten materials tested included zirconium silicate, magnesium aluminate, chromic oxide, ceric oxide, titania, barium titanate, calcium titanate, strontium titanate, iron-titanum-aluminum oxide, and iron-titanium oxide. Measurement of both total hemispherical and spectral normal emittances were made for all materials except ceric oxide and iron titanium oxide. Two different bonding methods were used for chromic oxide and calcium titanate and three different methods were used for zirconium silicate. One zirconium silicate coating was bonded to type 310 stainless steel rather than niobium-1% zirconium to determine the influence on coating emittance of the type substrate used. Specimens of zirconium silicate and iron-titanium oxide were endurance tested. (auth)

6676 (RADC-TDR-62-401) DIELECTRIC TO METAL SEAL TECHNOLOGY STUDY. First Quarterly Report, March 19, 1962–June 30, 1962. M. Berg, A. C. Grimm, and F. F. Marinaro (Radio Corp. of America. Electron Tube Div., Lancaster, Penna.). July 1962. Contract AF30(602)-2682. 65p.

A theoretical and experimental investigation is being conducted leading to the development of improved dielectric-to-metal seals and sealing techniques for use with output windows for high-power microwave tubes. Investigation of refractory metal and active metal processes has been initiated. The refractory metal processes are being used for synthetic sapphire and beryllium oxide. The active metal processes are being used for fused silica and pyroceram. A comprehensive literature survey has been compiled and is included. Various dielectric materials have been evaluated for electrical loss and mechanical strength, and optimum materials have been selected. Work on compression-band seals has been given priority over work on the metalized sealing techniques because no metalizing is employed in the seal. Other advantages of the compression-band seal are a minimum of radiofrequency loss and its adaptability to different dielectric materials. Several experimental seals were fabricated to learn the factors necessary to produce a practical seal. Although the seals failed, valuable information was accumulated. (auth)

6677 (RISO-48) BIBLIOGRAPHY ON DISPERSION STRENGTHENED MATERIALS. Niels Hansen and Hans Lilholt (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Sept. 1962. 82p.

This annotated bibliography consists of 629 references to available literature on dispersion strengthened materials and related problems, up to 1962. References are arranged alphabetically according to author. A subject index is included. (R.J.S.)

6678 (TID-14508) $Pb(Sc_{0.5}Nb_{0.5})_X\Phi_{1-X}O_3$, PEROVSKITE-TYPE FERRO-ELECTRIC SOLID SOLUTIONS POSSESSING RELATIVELY LARGE SPONTANEOUS POLARIZATIONS. V. J. Johnson, M. W. Valenta, J. E. Dougherty, R. M. Douglass, and J. W. Meadows (Los Alamos Scientific Lab., N. Mex.). [1960]. Contract [W-7405-eng-36]. 28p. (LADC-4581)

The spontaneous polarization and Curie temperature were measured for various compositions of the perovskite-type ferroelectric solid solution systems $Pb(Sc_{0.5}Nb_{0.5})_X\Phi_{1-X}O_3$, where Φ was either Ti, Zr, or Hf; ceramic samples were used in all the measurements. The maximum value for the spontaneous polarization of a particular system was found to decrease in value as Ti was replaced by Zr and Zr by Hf, although the corresponding concentration of the four valent Φ ion and the temperature at which the spontaneous polarization was measured were not necessarily the same for the three different compositions exhibiting the maximum spontaneous polarization; 30 $\mu coulomb/cm^2$ was the largest value which was observed for the spontaneous polarization. An increase in the concentration of Φ increased the Curie temperature of the respective solid solution system. Curie points tended to decrease in value, correspondlingly, as Ti was replaced by Zr and Zr by Hf. For perovskite-type ferroelectric solid solutions having the general stoichiometric formula $Pb[(B_I^{+a})_X(B_{II}^{+b})_Y \ldots]O_3$, it was found that the maximum room temperature spontaneous polarization is obtained when the average radius for all the B ions (of the metal–oxygen ochtahedra) is approximately 0.75 Å. (auth)

6679 (TID-15270) CATALYTIC OXIDATION OF GRAPHITE. G. R. Hennig (Argonne National Lab., Ill.). Jan. 1962. Contract [W-31-109-eng-38]. 26p. (UAC-5972)

Colloidal metal particles placed on graphite single crystals catalyze the oxidation of graphite. The catalysis occurs only at the metal-carbon interface. Spreading of catalytically active fragments from the particles was not observed for colloids of Au, Fe, Ni, or Pt. The particles produce characteristic etch patterns which are indicative of the crystal perfection. On crystals relatively free of defects, the catalysts attack parallel to cleavage surfaces. On crystals containing lattice defects or substitutional B impurities, the catalysts may also attack perpendicular to the cleavage surfaces and produce pits on it. Activation energies for catalysis were estimated from the etch patterns and are about 10 Kcal/mole parallel and 56 Kcal/mole perpendicular to the cleavage surface. Some details of the mechanism of catalytic action have been deduced. Vanadium is an exceptionally active catalyst for graphite oxidation. The reactions of graphite with gases, particularly with O_2 or CO_2, are strongly affected by various catalytic agents. The action of such catalysts has been investigated by microscopic studies of the surfaces of graphite single crystals. It was anticipated that catalysts

would produce pits on the surfaces of graphite crystals during reaction with O_2 or CO_2. However, it was shown that on carefully handled crystals metallic impurities usually do not produce catalytic pits. Special pretreatments such as particle irradiation, quenching, or extensive mechanical deformation were required to induce pitting. Pitting was attributed to attack of the catalyst at the vacancies. Pretreatment of the crystals by heating was originally carried out to remove residual impurities. However, heat treatment below 2700°C may sometimes convert an inactive impurity to a more active form. (auth)

6680 (TID-15539) MICROSTRUCTURAL CHANGES DURING THE α-β-α TRANSFORMATION OF URANIUM. C. L. Angerman (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Mar. 1962. Contract [AT(07-2)-1]. 10p.

The changes in the grain structure of U during an α-β-α transformation cycle were examined with a hot-stage optical microscope and photographed on movie film. An apparent "superheating" effect was observed while heating through the α-β transformation. A finite time at a β-phase temperature was required before the transformation front passed through the field of view. Cooling to the α phase before the α-β front passed resulted in grain growth without the passage of a front. A similar front was observed during the β-α transformation. In both transformations the main front was composed of "sub-fronts" that defined the resulting grain size. (auth)

6681 (TID-17492) PREFERRED ORIENTATION MEASUREMENT IN URANIUM BY THE NORTON ROD TECHNIQUE. E. A. Starke, B. G. LeFevre, and E. F. Sturcken (Du Pont de Nemours & Co. Savannah River Lab., Aiken, S. C.). Nov. 1962. Contract AT(07-2)-1. 19p.

The Norton Technique for determining pole figures was successfully applied to U by measuring part of a pole figure for α-rolled plate. The technique was found to be impractical for extremely large-grained materials such as β-heat-treated U without some modification of the apparatus which would allow a larger sample area to be scanned. A mathematical expression was developed for the random intensities from a cylindrical specimen and was verified by experiment. The mathematical expression is particularly suitable for normalizing partial pole figures to one another which cannot be normalized by the usual graphic methods. The expression is: $I_{hkl} = KI^0_{hkl}[1 + (\cos^2\theta/2 \sin\theta) \ln (1 - \sin\theta/1 + \sin\theta)]$ where I_{hkl} is the random intensity of the plane (hkl) for a cylindrical specimen, I^0_{hkl} is the calculated random intensity of the same plane for a flat plate specimen, θ is the Bragg angle for (hkl), and K is an arbitrary constant. The intensities of pole figures representing different crystallographic planes may be normalized by dividing them by I_{hkl}. (auth)

6682 (TID-17495) CALCULATION OF THERMAL EXPANSION COEFFICIENTS FOR ROLLED URANIUM SHEET. E. F. Sturcken (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [1961]. Contract AT(07-2)-1. 7p.

An expression was developed for calculating the thermal expansion coefficient α from the single crystal expansion coefficients α_a, α_b, and α_c and the grain orientation distribution function $P(u,\phi)$. Thermal expansion coefficients were measured using a Leitz dilatometer. (R.J.S.)

6683 (UCRL-6452(Pt.II) STUDIES OF BISMUTH ALLOYS. II. DISTRIBUTION OF SMALL ADDITIONS OF Cu, Ag, OR Au BETWEEN SOLID AND LIQUID PHASES IN Bi–Cu, Bi–Ag, AND Bi–Au. Marcel W. Nathans and Marjorie Leider (California. Univ., Livermore. Lawrence Radiation Lab.). May 23, 1961. Contract W-7405-eng-48. 15p.

The distribution of small amounts of radioactive Cu, Ag, and Au between precipitates of these elements and their solutions in Bi was investigated at different temperatures by sampling the liquid. In all cases the Doerner-Hoskins law was obeyed. Approximate distribution ratios were calculated and plotted against 1/T. Extrapolation to the melting temperature of the major component X in these Bi–X–Y systems yields values which compare well with the distribution constants obtained either from the binary X–Y phase diagrams or with those calculated from thermodynamic data. The data support solid solution formation as the mechanism of coprecipitation. This investigation also suggests a new method of obtaining significant portions of solidus curves. (auth)

6684 (UCRL-6748) COMPRESSIVE CREEP OF POLYCRYSTALLINE BERYLLIUM OXIDE. Richard R. Vandervoort and Willis L. Barmore (California. Univ., Livermore. Lawrence Radiation Lab.). Mar. 2, 1962. Contract W-7405-eng-48. 25p.

Compressive creep of polycrystalline beryllium oxide was studied in the temperature range 2500°F to 2800°F. The apparent activation energy for creep is 96.0 kcal/mol, and creep rate is linearly dependent on the applied stress. Results are consistent with the Nabarro-Herring creep mechanism. Experimental evidence shows extrapolation of data to 3200°F is possible. (auth)

6685 (UCRL-9992) THE EFFECT OF TEMPERATURE ON THE YIELD STRENGTH OF THE POLYCRYSTALLINE HEXAGONAL Ag–Al INTERMETALLIC PHASE. Kichinosuke Tanaka and Jim D. Mote (California. Univ., Berkeley. Lawrence Radiation Lab.). Dec. 18, 1961. Contract W-7405-eng-48. 20p.

The effect of temperature on the yield strength of the polycrystalline hexagonal Ag–Al intermetallic phase was investigated over the temperature range 77 to 775°K. It was found that the curve for yield stress vs temperature for both polycrystalline Ag–33 at.% Al specimens that were heavily cold-worked prior to deformation and those that were recrystallized prior to deformation was parallel to that for prismatic slip in single crystals. Increase of the percent Al in the specimens resulted in an abrupt decrease in the ductility at a composition of about 37 at.% Al. This decrease in ductility was attributed to precipitates in the grain boundaries. (auth)

6686 (UCRL-10012) THERMODYNAMIC STABILITY AND BOND MECHANISMS IN RELATION TO ELECTRONIC STRUCTURE AND CRYSTAL STRUCTURE. Leo Brewer (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 1962. Contract W-7405-eng-48. 23p.

Bonding of metallic systems is considered in terms of a valence bond model. (auth)

6687 (UCRL-10124) DIRECT OBSERVATIONS OF HETEROGENEOUS PRECIPITATION. J. A. Hren and G. Thomas (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 1962. Contract W-7405-eng-48. 10p.

A high temperature stage was used in Siemens Elmiskop I and Hitochi H. U. 10 electron microscopes to follow the stages of decomposition in supersaturated Al–20% Ag alloys. Information concerning direct evidence of dislocation reactions involved in the nucleation, growth, and dissolution of $\gamma'(Ag_2Al)$ precipitates is presented. (J.R.D.)

6688 (WADD-TR-60-37(Pt.III)) PHYSICAL METALLURGY OF TUNGSTEN AND TUNGSTEN BASE ALLOYS. Heinz G. Sell, George H. Keith, Ronald C. Koo, Randolph

H. Schnitzel, and Richard Corth (Westinghouse Electric Corp. Lamp Div., Bloomfield, N. J.). Apr. 1962. Contract AF33(616)-6933. 202p.

The tensile properties of polycrystalline W were investigated. Ductility decreased between 2000 and 4000°F, and it was found that annealing temperature has a greater effect on the D. -B. transition temperature than does grain size. Single crystals with a [100] orientation were grown by electron beam floating zone melting. The tensile deformation behavior of these crystals was studied from −196 to 800°C. Internal friction measurements were made on single crystals between 20 and 600°C and it was attempted to correlate damping peaks found at about 300 and 475°C with interstitial effects, carbon dosing experiments, and yield point phenomena. Single crystals were worked by rolling and their recrystallization response was investigated as a function of cold work and working temperature. Twin morphology was thoroughly studied. Binary solid solution alloy single crystals of W−Ta were produced by electron beam floating zone melting from compacted ingots. Alloy single crystals containing 0.25% and 4% Ta were worked and the recrystallization response was determined to be 400 to 600°C higher than that of worked pure W single crystals. The tensile strength of sintered and swaged W−TaC alloys was determined at 3000 and 3500°F as a function of alloy composition (0.1−1%). Also measured at 3000 and 3500°F were the tensile strengths of the systems W−2% ThO_2 and W−0.5% HfO_2. (auth)

6689 (WAL-TR-851.4/2) OXIDATION OF SEVERAL COMMERCIAL-GRADE GRAPHITES AT ELEVATED TEMPERATURES. Milton Levy and Philip Wong (Watertown Arsenal Labs., Mass.). Nov. 1962. 19p.

The oxidation characteristics of the commercially available graphites, Speer Carbon Co. Grades 580 and 7100 and Great Lakes Carbon Corp. H3LM and H1LM, were investigated for a series of temperatures between 1000 and 1550°F. The technique used permitted the continuous and automatic recording of oxidation rate. Oxidation-rate constants were calculated for each material at 1000, 1250, 1350, 1450, and 1550°F. Activation energies for each material were also calculated. The data were consistent with other reported data for commercial, natural, and pure artificial graphites. (auth)

6690 (WAPD-T-1268) SOME OBSERVATIONS CONCERNING ALPHA-BETA TRANSITIONS IN HYDROGEN-PALLADIUM. F. W. Pement and W. T. Lindsay, Jr. (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 1960. Contract AT-11-1-GEN-14. 23p.

In a series of experiments, Pd wire was cooled from 250°C to room temperature and held for periods up to 120 hrs. while immersed in 10^{-4} molar LiOH solution containing high concentrations of dissolved H_2 (up to 120 STP cc H_2/kg H_2O). The absorption of H_2 by the Pd was followed by resistance measurements. Very little H_2 was absorbed at temperatures below 150°C. At no time did the Pd transform completely to the beta phase. Partial transformation occurred when sufficient H_2 was absorbed above 150°C to allow cooling into the two-phase region at essentially constant H_2 concentration in the metal. Thus, the failure to transform completely was the result of the low rate of absorption and was not caused by inhibited nucleation of the beta phase or by slowness of the transformation itself. It is suggested that retarded absorption of H_2 is a characteristic of Pd in basic solution at low temperatures. (auth)

6691 (WAPD-T-1335) PREDICTION OF TENSILE PROPERTIES AT TEMPERATURES OTHER THAN THE TESTING TEMPERATURES. J. G. Goodwin and W. L. Davis (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). May 1961. Contract AT-11-1-GEN-14. 20p.

It is concluded that it is possible to predict with confidence the tensile properties of Zircaloy at temperatures other than the testing temperature. The deviation about the predicted values for both the process average and individual results can be obtained. The equations and curves can be extended with judiciousness to estimate tensile property values for other processes. Comparisons of recently published tensile property values for Zircaloy-2 with the values predicted here have demonstrated that the technique is practical. The statistical and experimental techniques employed can be adapted for estimating the tensile properties of other materials at temperatures other than the testing temperature. (R.J.S.)

6692 (AEC-tr-5486) INVESTIGATIONS OF CARBIDES. I. THE CRYSTAL STRUCTURE OF THE MeC_2 CARBIDES. M. v. Stackelberg. Translated for Oak Ridge National Lab., Tenn., from Z. Physik. Chem., 9B: 437-475(1930). 52p.

Results of X-ray investigations of CaC_2, SrC_2, BaC_2, LaC_2, CeC_2, PRC_2, NdC_2, and ThC_2 are presented. Results are also included which were obtained in similar investigations of $NaHC_2$ and KHC_2. (J.R.D.)

6693 (AEC-tr-5544) THE FRICTIONAL PYROPHORICITY OF ALLOYS. H. Nowotny and O. Smetana. Translated from Oesterr. Chemiker-Z., 58: 195-208(1957). 44p.

A historical survey is given of the development of the ignition metals with cerium and other metals of the cerite group. The manganese−antimony pyrophors and similar alloys are discussed. It is shown that for pyrophorous behavior not only is a high heat of combustion determinative, but a low ignition temperature is essential. Ignition temperatures were determined for a number of metals and pyrophorous alloys. A criterion of pyrophoricity is given which is primarily dependent on the temperature difference between the temperature generated in friction and the ignition temperature. The relations in the case of dry friction with respect to the wear on ignition metal are discussed. Pyrophorous alloys on the basis of the alkaline-earth and alkali metals are described. It was found, in general, that most elements of the strongly non-noble group of the periodic system are suitable as basic materials for pyrophorous alloys. All these alloys are distinguished by severe grid disturbances. (auth)

6694 (AEC-tr-5565) THE DEMONSTRABILITY OF THE CRYSTAL-STRUCTURE DISORDERS OF FINE CRYSTALLINE CARBONS. Pál Szabó. Translated for Argonne National Lab., Ill. from Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 7: No. 5, 296-301(1959). 6p.

The intensity scattered by fine crystalline carbons is discussed. It is demonstrated that the intensity formulas published in the literature do not take into proper consideration the presumed disorders, and the error resulting from this circumstance when the crystallite dimensions are determined in the customary manner, i.e., by the width of the Debye-Scherrer rings, is discussed. It is shown that an interpretation of diffuse scattered intensity in a case described in the literature is justified even without assuming the special kind of disorder postulated. This discussion shows that it is theoretically possible to determine the disorders on the basis of the scattered intensity. The kind of neutron-diffraction measurements required for this purpose is outlined. The practical application of the method is hampered, for the time being, by mathematical difficulties. (auth)

6695 (AEC-tr-5568) THE PLASTIC CHARACTERISTICS OF NICKEL–COBALT SINGLE CRYSTALS. W. Pfeiffer and A. Seeger. Translated for Oak Ridge National Lab., Tenn. from Phys. Status Solidi, 2: 668-91 (1962). 44p.

The orientation relation of the work-hardening curve and the overshooting of the crystal axis, the slip line pattern in the case of high deformations, and the yield point effect of plastically deformed Ni–40% Co single crystals were investigated. Results of this investigation as well as the concentration and temperature relations of the work-hardening curve for Ni–Co single crystals, which are known from earlier investigations, are discussed and compared with the characteristics of other cubic face-centered alloys and pure metals It was concluded that the series of cubic face-centered Ni–Co alloys can be considered extensively as the model for a metal with a variable stacking-fault energy. (auth)

6696 (EURAEC-353) INVESTIGATION OF ALLOYS OF ZIRCONIUM WITH NIOBIUM AND TIN IN VIEW OF THEIR APPLICATION AS SHEATHING MATERIAL IN WATER-COOLED NUCLEAR REACTORS. Special Technical Report No. 2. (Metallgesellschaft A. G., Frankfurt am Main). May 10, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 047-61-4RDA. 37p. A translation.

In Zr alloys containing Nb, H_2 has stabilizing action on the β_{Zr}-phase and extends the β_{Zr}-field. This promotes the formation of a martensitic transformation texture within the concentration range under test. Coarse needle-shaped hydride precipitates in alloys with about 3% of Nb (and an addition of up to 1% of Sn) mainly occur after quenching down from temperatures above 700°C, on account of a decline in the solubility of H_2 in β_{Zr}. Hydrogen can be made to dissolve in the α_{Zr} and/or in the β_{Nb} phase by applying a slow cooling rate, which prevents the separation of coarse hydride precipitates. Hydrogen reduces the deformability, especially at room temperature. The effect on the yield strength limits, on the strength, and on the creep behavior depending on time differs on account of a simultaneous influence on the hardening. Thus, in Nb-containing Zr alloys with very small permanent deformations, H_2 decreases yield strength and time yield limits. The elongation limits with higher elongations and the strength are however increased due to the higher cold-hardening. In the Nb-containing alloys Zr–2% Nb and Zr–3% Nb–1% Sn, a H_2 content shifts the sudden drop of the notch impact strength toward higher temperatures, but H_2 contents do not increase the brittleness to the same extent as in Zircaloy-2. (auth)

6697 (EURAEC-358) INVESTIGATION OF ALLOYS OF ZIRCONIUM WITH NIOBIUM AND TIN IN VIEW OF THEIR APPLICATION AS SHEATHING MATERIAL IN WATER-COOLED NUCLEAR REACTORS. Special Technical Report No. 4. (Metallgesellschaft A. G., Frankfurt am Main). May 23, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 047-61-4 RDA. 20p. A translation.

A metallographic and x-ray study of the Zr apex of the Nb–Sn–Zr ternary system was made in the temperature range of 575 to 750°C on alloys obtained from spongy Zr. The solubility of Sn in α-zirconium diminishes with rising temperature in the temperature range in question, whereas that of Nb decreases. The state of equilibrium is attained very slowly at 590 to 650°C and complete equilibrium is not reached even after 100 hr of annealing. In the Zr–3% Nb–1% Sn alloy, which has been thoroughly investigated on account of its application in water-cooled nuclear reactors, the Sn content at temperatures between 575 and 750°C is present in the dissolved state in α-zirconium. (auth)

6698 (NP-tr-929) THE RECRYSTALLISATION OF ZINC BY THERMAL CYCLING. D. Buttinelli and G. de Gregorio. Translated by H. E. Nowottny (U.K.A.E.A Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Met. Ital., 52: 835-41(1960). 21p. (CNEN-63)

The behavior of zinc during recrystallization resulting from thermal cycling is described. Tests were carried out on zinc specimens of equal purity (99.9%) but with different prior treatments (as-cast, annealed, rolled) and, under specified conditions, until the production of single crystals. Results are presented in diagrams and photographs. They show the influence of the variable factors of cycling on the rate of grain growth and on the changes occurring in the process. The energy of activation of the process in the second cycle was calculated on the basis of the equation proposed by Beck for the recrystallization, with appropriate transformations. (auth)

6699 (SCL-T-451) ABSORPTION OF HYDROGEN AND DEUTERIUM BY METALLIC TITANIUM. Toshizo Chitani, Yoshihide Naito, and Atsuo Konishi. Translated by Noburu Hiraga (Sandia Corp., Albuquerque, N. Mex.) from Nippon Kagaku Zasshi, 77: 295-7(1956). 8p.

The equipment and procedures are detailed. Pulverized Ti was placed into quartz containers in a system consisting principally of two containers, holders for H_2 and D_2, an electric furnace, a vacuum pump, a Hg manometer, and a thermocouple. Absorption isotherm lines were obtained for both H_2 and D_2. Results are shown graphically. (R.J.S.)

6700 (UCRL-Trans-892(L)) THE THERMOELECTRIC POWER OF THIN METALLIC FILMS. E. Justi, M. Kohler, and G. Lautz. Translated by James G. Prather and George A. Condas (Univ. of California Lawrence Radiation Lab., Livermore) from Z. Naturforsch., 6a: 456-9 (1951). 9p.

The effect of the mean free path of electrons on the electric conductivity, the magnetic resistance variation, and the a-c current resistance of thin wires and films is discussed. On the basis of theoretical considerations, a decrease in the differential thermoelectric power with a slightly decreasing film thickness would be expected. This effect on thin evaporated films of spectroscopically pure Bi was experimentally demonstrated. There results a decrease of 14% of the bulk material value at about 100/A film thickness. The discovered thickness dependence can be explained through an effect of the mean free path of electrons, through an increase in the apparent electron mass as a consequence of a variation of the Fermi-energy of thin films, through effect of surface conditions, and through inhomogeneities in the surface layers. (auth)

6701 STUDY OF THE ELECTRONIC STRUCTURE OF RARE EARTH METALS. Yves-Andre Rocher (Universite, Paris). Advan. in Phys., 11: 233-79(July 1962). (In French)

The systematics of the electronic states (conduction and internal) of the 4f rare earths are studied theoretically. Investigations are carried out for the cases in which the 4f electrons occupy bound states or virtual bound states. The model of virtual bound states is applied to Pu. (T.F.H.)

6702 VACANCIES AND DISLOCATION LOOPS IN GRAPHITE. G. R. Hennig (Argonne National Lab., Ill.). Appl. Phys. Letters, 1: 55-6(Nov. 1962). (UAC-6511)

Electron microscope studies were undertaken to determine concentrations and mobilities of vacancies in graph-

ite. Crystals were quenched and annealed to various temperatures. Crystals under strain (some deliberately bent) before heat treatment contained larger numbers of loops while crystals treated under strain-free conditions showed no loops. Crystals quenched from 3000°C showed no loops even when bent or irradiated with neutrons, indicating that loops are not produced by coalescing of excess quenched-in vacancies. (D.C.W.)

6703 A NOTE ON SOME OF THE INTERMEDIATE PHASES IN THE Nb–Sn SYSTEM. M. L. Picklesimer (Oak Ridge National Lab., Tenn.). Appl. Phys. Letters, 1: 64-5(Nov. 1962).

Recently discovered superconducting properties of Nb–Sn make essential a reexamination of the equilibrium diagram of the system. One to four intermediate phases were reported by earlier investigators; but this experiment using "Kunzler" wires, niobium clad with a mixture of niobium and tin powder in the core, revealed at least five phases for all wires. Diagrams of stability disagree with earlier diagrams. (D.C.W.)

6704 THE RESISTIVITY OF COATING SYSTEMS TO ENERGETIC RADIATION. Wolfram A. Riese. At. Strom., 8: 57-9(Aug.-Sept. 1962). (In German)

Coating systems can be divided into two groups with reference to their resistance to high-energy radiation. In the first group, the coating materials contain relatively radiosensitive binders of organic polymers. The second group consists of compounds and groups with high stability. Typical examples of this second group are described, and some chemical groups with high stability are shown. (J.S.R.)

6705 THE MEASUREMENT OF THE LONG-DISTANCE ORDER PARAMETER IN β-BRASS USING NEUTRON SCATTERING. J. Roussel (Faculté des Sciences, Orsay, France and Centre d'Études Nucléaires, Saclay, France). Bull. soc. Franc. Mineral. Crist., 85: 57-67(1962). (CEA-1953). (In French)

The ordered structure of β brass was studied by neutron scattering. The order parameter was determined from room temperature to 450°C on unquenched samples. The results are in good agreement with others obtained on quenched samples using x rays. It was possible, accessorily, to give accurate values of the Zn and Cu cross sections. (auth)

6706 MAGNETIC STRUCTURE OF THE ALLOYS YCo_5 AND $HoCo_5$. Williams James, Rémy Lemaire, and Félix Bertaut (Centre d'Etudes Nucleaires, Grenoble, France). Compt. Rend., 255: 896-8(July 30, 1962). (In French)

Neutron diffraction measurements on YCo_5 and $HoCo_5$, prepared by metal fusion under argon, are reported. In YCo_5 the interactions between the atoms are ferromagnetic. The intensities observed and calculated at 300°K for YCo_5 and for $HoCo_5$ at 4.2 and 300°K are tabulated. (J.S.R.)

6707 PLASTIC DEFORMATION AND RUPTURE OF URANIUM MONOCRYSTALS BY TRACTION AT –196°C. André Lemogne and Paul Lacombe (Ecole des Mines, Paris). Compt. Rend., 255: 920-2(July 30, 1962). (In French)

The traction deformation at –196°C of U monocrystals prepared by phase variation presents the same types of deformation as appear at room temperature with the exclusion of deformation bands and deflected slips. The predominance of twinning is accompanied by rupture with slight elongation following the composition planes of the twin. (tr-auth)

6708 THE SURFACE TENSION OF LIQUID METALS AS A FUNCTION OF TEMPERATURE. S. N. Zadumkin and P. P. Pugachevich (Kabardino-Balkarskii State Univ., USSR and Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk SSSR, 146: 1363-6(Oct. 21, 1962). (In Russian)

On the basis of a static electron theory of the surface tension of a liquid metal, an expression was derived for the value of $d\sigma/dT$ for a number of metals. The anharmonicity of the ion oscillations and the Fermi distribution function for an electron gas at $T \neq 0$ were taken into account. The final expression is as follows: $d\sigma/dT = -\{(0.044\ \sigma/T_s) + (0.328/V_a)(V_a/Z)^{0.167}[1 + 0.832(T/T_s) + 0.82 \times 10^{-4}(Z/V_a)^{0.333} V_a T]\}$. Here T_s is the melting temperature, and V_a is the atomic volume. The value of $d\sigma/dT$ was calculated from this formula for the following liquid metals: Li, Na, K, Rb, Cs, Cu, Ag, Au, Be, Mg, Ca, Sr, Ba, Zn, Cd, Hg, Al, Ga, In, Tl, Sn, Pb, Sb, Bi, Cr, Co, Ni, Rh, and Pd. The calculated values of $d\sigma/dT$ are in satisfactory agreement with the experimental values for the non-transition metals. (TTT)

6709 THE ELASTIC PROPERTIES OF TITANIUM–ALUMINUM ALLOYS. S. G. Fedotov, T. T. Nartova, and E. P. Sinodova (Baikov Inst. of Metallurgy, USSR). Doklady Akad. Nauk SSSR, 146: 1377-9(Oct. 21, 1962). (In Russian)

Al-Ti alloys were prepared by arc fusion. Alloys containing >12 wt % Al were poured in an argon atmosphere. Young's modulus (E), the shear modulus (G), the Poisson coefficient μ, and the density γ were determined on well-annealed samples over a range of 0 to 40 wt % Al. An addition of 5 to 6 wt % Al caused a sharp increase in the elastic properties of the Ti-Al alloys. At 9 to 10 wt % Al, there was another sharp jump in elastic properties due to the formation of Ti_2Al. At 16 wt % Al, the maximum Young's modulus, corresponding to the formation of Ti_3Al, was 15,700 kg/mm^2, which is almost 1.5 times greater than the Young's modulus for pure titanium. The alloys with 20 to 25 wt % Al showed a slight drop in elastic properties. At >25 wt % Al, a two-phase $\alpha + \gamma$-region occurred, and the value of Young's modulus rose to 19,000 kg/mm^2 due to the formation of TiAl. These data are useful in improving the elastic and heat-strength properties of titanium alloys. (TTT).

6710 STRUCTURAL HARDENING OF COPPER–BERYLLIUM ALLOYS. L. Chollet and J. P. Jan (Laboratoire Suisse de Recherches Horlogeres, Neuchatel, Switzerland). Helv. Phys. Acta, 35: 250-3(1962). (In French)

The x-ray diffraction diagrams of two commercial Cu–Be alloys, one of which had been tempered at 800°C and rolled and the other only tempered at 800°C, are discussed. The diagrams reveal a complex structure in the γ phase. An interpretation of the γ phase is attempted. The results also showed the importance of the tempering conditions. (J.S.R.)

6711 THE TEMPERATURE RANGE OF LIQUID LEAD AND SILVER AND AN ESTIMATE OF THEIR CRITICAL CONSTANTS. A. V. Grosse and A. D. Kirshenbaum (Temple Univ., Philadelphia). J. Inorg. Nucl. Chem., 24: 739-48(Nov. 1962).

Temperature range diagrams of liquid Pb and Ag were constructed from experimental density data, from their melting points to their normal boiling points, the law of rectilinear diameter, and the theorem of corresponding states. From the diagrams or the equations on which they were based, the critical constants were estimated and are tabulated. (auth)

6712 APPLICATION OF THE TECHNIQUE OF THIN FILMS TO ELECTRON MICROSCOPE STUDIES OF URANIUM–MOLYBDENUM ALLOYS OF TWO PHASES. M. N. Azam and J. Lehmann (Commissariat à l'Energie

Atomique, Saclay, France). J. Nucl. Mater., 7: 26-31 (Sept.-Oct. 1962). (In French)

Some examples are reported of results obtained by electron microscopic examination of thin films of two-phase uranium-molybdenum alloys. The films are prepared from pieces removed from massive samples which had undergone various thermal treatments. Comparison with micrographs obtained by taking surface replicas showed that the amount and quality of information obtained by the thin-film technique largely compensates for the technical difficulties involved. (auth)

6713 THE $\alpha \rightleftharpoons \beta$ PHASE TRANSITION IN PURE URANIUM. J. Burke and P. H. Dixon (Univ. of Liverpool). J. Nucl. Mater., 7: 38-45(Sept.-Oct. 1962). (In English)

A critical review of previous work on the α/β transition in pure uranium is presented. It is shown that the $\beta \rightarrow \alpha$ change is diffusional at slow cooling rates and martensitic during fast cooling and that the $\alpha \rightarrow \beta$ change is always diffusional except in the very special case of the transformation of martensitic α which transforms by reversal of the primary shear if the heating rate is sufficiently rapid. The two current theories of remnant textures in α uranium are examined in the light of the above conclusions and both found to be unsatisfactory. An alternative explanation is proposed based upon the probable effects of β grain size on the $\beta \rightleftharpoons \alpha$ transformations. (auth)

6714 SUITABILITY OF CADMIUM TANTALATE AS CONTROL MATERIAL FOR HIGH-TEMPERATURE REACTORS. F. Haessner, G. Petzow, and E. Preisler (Max-Planck-Institut für Metallforschung, Stuttgart). J. Nucl. Mater., 7: 46-57(Sept.-Oct. 1962). (In German)

Cadmium tantalate has attractive properties as a neutron absorbing material for use at elevated temperatures. These properties include a high thermal and epithermal absorption cross-section, no radiation-induced formation of helium, a cubic crystal lattice, no crystallographic transformations, and low raw material cost. The preparation of the compound is very simple: tantalum pentoxide and cadmium oxide are sintered together at 900°C. Above 1000°C the compound decomposes in circulating air at atmospheric pressure. Among metals, compatibility is good with copper up to 1000°C and presumably also with silver. (auth)

6715 THE ROLE OF POROSITY IN THE ACCOMMODATION OF THERMAL EXPANSION IN GRAPHITE. A. L. Sutton and V. C. Howard (United Kingdom Atomic Energy Authority, Culcheth, Lancs, Eng.). J. Nucl. Mater., 7: 58-71(Sept.-Oct. 1962). (In English)

Analysis of crystal orientation and the thermal expansion behavior of two blocks of British reactor grade A graphite has shown that accommodation of thermal expansion is associated with the crystallographic c-axis, some 37% of the c-expansion contributing to that of the bulk. This result is confirmed by analysis of the thermal expansion behavior of several different types of reactor graphite and of a pressed natural graphite. It is shown that the thermal expansion behavior of polycrystalline graphite may be characterized by two basic parameters, one a measure of the effective contribution of lattice c-expansion to that of the bulk material, the other a measure of the preferred orientation of the crystals. These parameters may be derived from measurements of the linear thermal expansion coefficients at 400°C in directions parallel and perpendicular to that of extrusion or pressing. Accommodation of thermal expansion in reactor graphite is attributed to the presence of transcrystalline cleavage cracks, observed by electron microscopy of replicas. These cracks exist in parallel arrays, with individual crack length up to ~10 μm, mean width ~250 Å, and mean periodicity ~2 cracks/μm. Their estimated volume agrees well with that of the closed porosity, 4.3% relative to the volume of crystalline material, derived from density measurements by x-ray diffraction and helium displacement. The cracks are believed to have been initiated during cooling from the graphitization temperature, ~2700°C, and are thought to have formed in order to relieve internal stresses generated by interaction between the restraining effect of strong, intercrystalline C–C bonds and anisotropic contraction of the crystal lattice. Evidence is given that the marked increase in thermal expansion observed in the course of neutron irradiation of reactor graphite at 200°C is associated with the closing of cleavage microcracks. (auth)

6716 THE ANNEALING OF A QUENCHED URANIUM-5 AT % MOLYBDENUM ALLOY. G. H. May (C. A. Parsons and Co. Ltd., Newcastle-upon-Tyne, Eng.). J. Nucl. Mater., 7: 72-84(Sept.-Oct. 1962). (In English)

Three reactions have been observed in the annealing of γ-quenched U-5 at. % Mo: age-hardening in the supersaturated α'_b phase; over-ageing with recrystallization and discontinuous precipitation of non-equilibrium γ; and a second recrystallization with re-precipitation to form a pearlitic structure. Mechanisms are proposed for all three reactions, and a possible explanation of the irradiation-swelling properties of the quenched structure is suggested. (auth)

6717 STUDY OF THE CRYSTALLINE ANISOTROPY OF ARTIFICIAL GRAPHITE BY NEUTRON DIFFRACTION. Marcel Lecomte (Centre d'Études Nucléaires, Saclay, France). J. Nucl. Mater., 7: 92-8(Sept.-Oct. 1962). (In French)

The Saclay spectrometer at EL 2 has been used to investigate the structural properties of artificial graphite. Information as to the local texture at different points of a small block of graphite has been obtained. The method is more rapid and yields results which are statistically more accurate than those found by x-ray diffraction. In particular, the method allows the determination of the degree of anisotropy in directions normal to the axis along which the block was compressed during its manufacture. (auth)

6718 URANIUM-FISSIUM ALLOYS CONTAINING TECHNETIUM. Robert W. Bohl (Univ. of Illinois, Urbana). J. Nucl. Mater., 7: 99-100(Sept.-Oct. 1962). (ANL-FGF-319). (In English)

A recent study (Report ANL-6495) was completed in which the phase relationships and decomposition kinetics of alloys with the complete fissium analysis were measured and compared with U-Fs alloys without technetium. The presence of the Tc addition appeared to have a relatively minor influence on the U-Fs alloys. (W.D.M.)

6719 DETERMINATION OF THE COMPOSITION OF THE SECOND PHASE IN ZIRCALOY. G. Oestberg (Aktiebolaget Atomenergi, Stockholm). J. Nucl. Mater., 7: 103-6 (Sept.-Oct. 1962). (In English)

The corrosion resistance of Zircaloy-2 in high-temperature water is structure-dependent, the maximum resistance being obtained when the second phase is present as evenly distributed particles with a maximum diameter of the order of one or two microns. An attempt to arrive at more precise values for the composition of the second phase is described. (W.D.M.)

6720 VARIATIONS IN X-RAY BARRIER EFFICIENCY OF SOME COMMONLY USED BUILDING MATERIALS. Walter S. Moos, Richard E. Haas, Seymour H. Yale, and J. Donald Hauptfuehrer (Univ. of Illinois, Chicago). Oral Surg., Oral Med., Oral Pathol., 14: 569-73(May 1961).

The relative x-ray barrier efficiency of some commonly used building materials was determined in order to provide additional methods of reducing office-to-office radiation in multiple-office professional buildings. Per-cent transmission and half-value layer measurements are tabulated for 15 commercially available materials, for various x-ray intensities. Galvanized iron is an effective barrier material for x-ray energies commonly encountered in dental offices, comparing relatively well with the absorption qualities of lead. Materials such as wood and dry wall, frequently used for wall partitioning, are poor absorbers of x radiation. The growing popularity of multiple-office professional buildings presents a special problem in the control of radiation emanating from x-ray machines in adjacent offices. (H.H.D.)

6721 CRYSTAL STRUCTURE VARIATIONS IN ALPHA URANIUM AT LOW TEMPERATURES. C. S. Barrett (Univ. of Chicago), M. H. Mueller, and R. L. Hitterman. Phys. Rev., 129: 625-9(Jan. 15, 1963). (ANL-FGF-367)

The unusual temperature dependence of the elastic moduli and other physical properties of alpha uranium near 43°K which have been previously reported to be correlated with changes in atomic position and with cell dimensions. The atom position parameter, y, decreases to a minimum at 43°K and then rapidly rises on further cooling, as shown both by x-ray and neutron data. The a_0 and b_0 cell dimensions decrease to a minimum at 43°K and then rapidly increase, giving a large negative linear expansion coefficient in the range 43 to 18°K; the c_0 dimension contracts on cooling to 43°K and decreases even more rapidly below this temperature thus giving a higher positive linear expansion coefficient in the 43 to 18°K range. Neutron diffraction experiments disclose the existence of additional reflections at the lower temperatures which are presumably due to a magnetic moment arrangement. (auth)

6722 ETCHING OF GRAPHITE SURFACES WITH OXYGEN. E. E. Glenda Hughes, B. R. Williams, and John M. Thomas (University Coll. of North Wales, Bangor). Trans. Faraday Soc., 58: 2011-16(Oct. 1962).

A detailed study was made of the etch pits produced on the basal planes of graphite by oxidation with O_2 in the range 700-870°C. The orientation and internal shape of the pits were interpreted in terms of the known structural characteristics of the graphite lattice. Results indicate that carbon atoms exposed at the planes $\{11\bar{2}l\}$ gasify more slowly than the atoms exposed at other prismatic planes, especially those of the form $\{10\bar{1}l\}$. Various agencies which may be responsible for the hexagonal pitting are discussed briefly. (auth)

6723 STRESS RUPTURE PROPERTIES OF HIGH-NITROGEN 308L WELD METALS. Thomas J. Moore (Arcos Corp., Philadelphia). Welding J., (N. Y.), 41: No. 4, 175-s-81-s(Apr. 1962). (NYO-3503)

Two new types of lime-coated electrodes have been evaluated for welding Type 347 stainless steel, namely: partially ferrite Type 308L, containing 0.1 to 0.2% N, and fully austenitic Type 308L, containing 0.1 to 0.2% N and 6% Mn. All-weld-metal tensile tests and segmented circular groove cracking test results have shown these new compositions to be sound and resistant to hot-cracking. At 1200°F, both types of high-nitrogen 308L electrodes were found to be suitable for welding Type 347 base material on the basis of their stress rupture properties. At 1000°F, the partially ferritic electrodes essentially match the base metal strength, but the stress rupture points for the fully austenitic electrodes fall below the Type 347 base metal scatterband. In special corrosion and/or non-magnetic applications, the fully austenitic composition offers unique advantages. Charpy impact data on the new weld metals are presented at room temperature, −150°F, and −320°F. (auth)

6724 THE RELATIONSHIP BETWEEN PHASE INTERFACIAL PROCESSES AND DIFFUSION PROCESSES AND THE ELASTOMECHANICAL BEHAVIOR OF ZIRCONIUM–NITROGEN ALLOYS. Karl Bungardt, Hans Preisendanz, and Elisabeth Horn (Deutsche Edelstahlwerke A. G., Krefeld, Ger.). Z. Metallk., 53: 495-503(Aug. 1962). (In German)

The relation between internal friction and diffusion of nitrogen in zirconium was investigated. After loading the specimen with nitrogen the peak of the damping capacity between −100 and 30°C was measured which is very broad and points to a mechanism influenced by many factors. In the same temperature range the shear modulus is different from that of pure zirconium. There is indeed a slight dependence of the damping peak on the up-taken nitrogen, a clear relation however was not found. After loading with gas and the following homogenizing the damping peak is largely reduced although the percentage of nitrogen does not change. Below 0.5% nitrogen it is possible nearly to suppress the damping-phenomena. Microscopic examinations show that a clear damping anomaly does not occur before the formation of a circular reaction zone caused by the taking-up of nitrogen. The results can be interpreted by assuming that states of stress between regions rich in nitrogen and those low in nitrogen are responsible for the appearance of the damping peak between −100 and 30°C. It is left open how much the nitrogen atoms are involved and which specified mechanism is effective. (auth)

6725 STRUCTURE AND PROPERTIES OF URANIUM–VANADIUM–MOLYBDENUM. Guenter Petzow and Gunnar Gitlesen (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 517-24(Aug. 1962). (In German)

The ternary system uranium–vanadium–molybdenum was established by means of micrography, thermal analysis, temperature-temperature difference measurements, and x-ray examinations. The planes of primary crystallization and the course of the melting grooves were determined. Isothermal sections at 1000, 600, and 500°C and 4 temperature-concentration sections are presented which give an idea of the shape of the phase region in dependence on temperature and concentration. Two four-phase equilibria were observed at 620 and 550°C. Finally some properties of the uranium–vanadium–molybdenum alloys are stated; especially transformation behavior, forming property, and strength are discussed. (auth)

6726 THE RATE OF EVAPORATION OF TANTALUM IN A VACUUM. Erich Gebhardt, Hans-Dieter Seghezzi, and Horst Keil (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 524-5(Aug. 1962). (In German)

The rate of evaporation of tantalum in vacuum was measured between 2900 and 3150°K by following the increase of the electrical resistance of current-heated wires. The attenuation of the wire cross section and consequently the evaporated amount of tantalum was calculated from the increase of the resistance. The diameters of the specimen were 50 to 200 μ; the vacuum was 6×10^{-6} torr. The equation $v = 1.55 \times 10^{11} \times e^{-115000/T}$ g cm^{-2} s^{-1} was found for the temperature dependence of the rate of evaporation. The enthalpy of evaporation was computed to be 230 kcal/mol. (auth)

6727 THE QUASIBINARY SYSTEM UFe_2–UAl_2. Guenter Petzow, Siegfried Steeb, and Raghav Tank (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 526-9(Aug. 1962). (In German)

The pseudo-binary system of UFe_2-UAl_2 was established by means of micrography, thermal analysis, temperature-

temperature difference measurements, and x-ray examinations. An eutectic three-phase equilibrium (S = UFe_2 + UFeAl) was formed which extends from 13 to 22 at. % Al at 1015°C and which has an eutectic point at 20.5 at. % Al. Also a peritectic three phase-equilibrium was discovered with 33 to 53 at. % Al at 1060°C. In medium concentration ranges a ternary Laves phase of the C14($MgZn_2$) type occurs whose phase region extends from 22 at. % Al at 1015°C to 40 at. % Al at 1060°C. UFe_2 can dissolve up to ≈13 at. % Al under drifting of the unit cell, while UAl_2 takes up into solid solution up to 13 at. % Al under contracting of the unit cell. (auth)

6728 THE DIFFRACTION OF ELECTRON BEAMS ON DOUBLE LAYERS OF URANIUM DIOXIDE. Siegfried Steeb (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 541-7(Aug. 1962). (In German)

During the evaporation of uranium in high vacuum on a heated clean cleavage surface of rocksalt a single crystal film of UO_2 is formed. Either by an overlap of two single crystal layers during preparation or by direct growing from the vapor phase double layers are also often formed. In electron transmission photographs from these double layers many additional spots, so-called "double diffraction spots," are observed. The position and intensity of these spots may be well explained by the kinematic theory of electron diffraction. Because only certain rotation angles between the two single crystal layers are obtained it may be concluded that the two layers must be in very close contact. (auth)

6729 THE STRUCTURE OF SOME SYSTEMS QUASI-HOMOLOGOUS AND HOMOLOGOUS TO T^4-B^3. II. THE SYSTEMS TITANIUM–ALUMINUM, ZIRCONIUM–ALUMINUM, HAFNIUM–ALUMINUM, MOLYBDENUM–ALUMINUM, AND SOME TERNARY SYSTEMS. Manfred Poetzschke and Konrad Schubert (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 548-61(Aug. 1962). (In German)

Some new phases were found in the alloy systems titanium-aluminum, zirconium-aluminum and molybdenum-aluminum, and the constitutional diagram of hafnium-aluminum was expanded. The structures of several compounds could be analyzed. The morphotropy DO_{23}-DO_{22} was investigated on the quasibinary sections $ZrAl_3$-$NbAl_3$, $ZrGa_3$-$NbGa_3$, $ZrAl_3$-$ZrSi_3$, and $ZrGa_2$-$ZrGe_2$. The structures observed are described, and structural relations and atom volumes are discussed. (auth)

6730 DIAGRAM OF STATE OF CERIUM IN THE RANGE 20 TO 350°C UNDER A PRESSURE UP TO $80 \cdot 10^3$ kg/cm^2. L. D. Livshits, Yu. S. Genshaft, and V. K. Markov (Inst. of Chemical Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1262-7(Oct. 1962). (In Russian)

The diagram of the phase transition $\gamma \rightleftharpoons \alpha$ for cerium is continued to 350°C. It is found that the boundary between the regions of existence of γ and α phases in the region of 200°C deviates from linearity towards the temperature axis. It is established that the relative variation of resistance $\Delta R/R_\gamma$ in the transition retains a finite magnitude up to 350°C and diminishes in nonlinear fashion with increasing temperature above 170 to 180°C, thus making it impossible to extrapolate this magnitude to zero. Thus, the data obtained do not confirm the existence of a critical point up to 350°C, and in the light of these data the existence of such a point is very doubtful. The existence is confirmed of a minimum and maximum on the curve R(ρ) for cerium at pressures somewhat higher 50×10^3 and 70×10^3 kg/cm^2, respectively. The effect of temperature increase on the growth of pressure of these extermal points is shown. (auth)

6731 THE EMITTANCE OF MATERIALS SUITABLE FOR USE AS SPACECRAFT RADIATOR COATINGS. W. H. Askwyth, R. J. Hayes, and G. Mikk (Pratt and Whitney Aircraft Div., United Aircraft Corp., East Hartford, Conn.). ARS Preprint No. 2538-62. New York, American Rocket Society, 1962. Prepublication Copy. 30p.

Various test facilities were used for routine measurements of total hemispherical emittance, at high vacuum, over a wide range of temperatures. Total hemispherical emittance was obtained in vacuum by measuring the electrical power dissipated per unit area in a metal tube or strip (using direct electrical resistance heating) and comparing this to the emissive power of a black body at the temperature of the test piece. Total hemispherical emittance was determined for approximately 100 samples at temperatures which varied from 200 to 2200°F for some of these samples. The temperature range most frequently investigated was 300 to 1450°F with particular emphasis on temperatures of 1350 and 1450°F. The tests were conducted at vacuum levels which varied between 10^{-6} and 10^{-9} mm Hg. The test samples were usually coated metal strips or coated thin-walled metal tubes. Several coating methods were used but emphasis was placed on plasma arc spraying and aluminum phosphate bonding. Only those materials which show promise as being suitable for high temperature spacecraft radiators are discussed. These materials are divided into three groups; titania-bearing oxides; oxides of nickel, chromium, and iron; and a miscellaneous group which includes boron, boron carbide, silicon carbide, and acetylene black. In addition to determining emittance as a function of temperature, many of these materials were maintained in high vacuum at constant temperature (usually 1450°F) for periods of several hundred hours. This was to observe changes in emittance, if any, resulting from a prolonged exposure to high vacuum at these temperatures, as well as to observe possible deterioration of the coating-substrate bond. (auth)

Radiation Effects

Refer also to abstracts 7136, 7548, 7553, and 7554.

6732 (62-GC-207) RESEARCH DIRECTED TOWARD THE STUDY OF THE RADIATION DAMAGE THRESHOLDS OF THE ELEMENTS. Scientific Report No. 5. P. G. Lucasson and R. M. Walker (General Electric Co. Research Lab., Schenectady, N. Y.). June 1962. Contract AF19(604)-5557. 45p. (AFCRL-62-134; AD-276651)

The changes in residual electric resistance produced by bombardment with high energy electrons were measured for a number of metals as a function of electron energy in the range from 0.5 to 1.5 Mev. The irradiations were performed at 20°K and lower and recovery measurements were made up to 300°K. The production curves were analyzed using simple displacement theory and values were found for the average threshold energies. Approximate values for the resistivities of Frenkel pairs were also obtained. In the case of Al it was necessary to take secondary defect production into account; and a number of representative theoretical curves, based on different assumptions concerning the process of secondary defect production, are included. The behavior of Zn was anomalous in that the added resistivity was not a linear function of electron dose at 20°K. (auth)

6733 (62-GC-209) RESEARCH DIRECTED TOWARD THE STUDY OF THE RADIATION DAMAGE THRESHOLDS OF THE ELEMENTS. Scientific Report No. 6. P. G.

Lucasson and R. M. Walker (General Electric Co. Research Lab., Schenectady, N. Y.). June 1962. Contract AF19(604)-5557. 16p. (AFCRL-62-199; AD-276652)

Electron damage measurements previously have been used to obtain values for the average threshold energies and for the electric resistivities of Frenkel pairs in a number of metals. It is shown that there is an empirical correlation between the point defect resistivities so obtained and the normal, high-temperature electric resistivities of different metals. The threshold energies are discussed and extrapolations are made to predict values for certain metals whose threshold energies have not yet been measured. The low temperature (Stage I) recovery of most of the metals studied is shown to be qualitatively similar to that in Cu, and the correlation of recovery temperatures with certain bulk properties is discussed. The radiation damage parameters derived from the electron results are used to compare theory and experiment for irradiations performed with heavy particles. It is shown for neutron irradiations that there is a general tendency for the simple displacement theory to give better agreement with experiment as the atomic weight of the bombarded material increases. (auth)

6734 (AAEC/E-99) THE EFFECT OF NEUTRON IRRADIATION ON BERYLLIUM OXIDE. B. S. Hickman (Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Oct. 1962. 52p.

Fast neutron irradiation affects the properties of beryllium oxide by causing displacements and by causing nuclear transmutations. The overall aims of a program to investigate this problem are outlined, information from overseas laboratories is reviewed, and results obtained to date at Lucas Heights are described. Results are given of measurements of properties of beryllium oxide fabricated by various methods and irradiated to doses of up to 7×10^{20} nvt (fission neutrons) at temperatures of 75 to 700°C. The properties include macroexamination, dimensions, porosity, lattice parameter and line broadening, mechanical properties, thermal conductivity, metallography, and long wavelength neutron scattering. It is shown that an anisotropic lattice growth occurs which results in crumbling of the material at high doses. The damage rate is much smaller for irradiation at 500 to 700°C than for equivalent doses at 100°C. Fine-grained ($< 3\mu$) material withstands crumbling up to much higher doses than coarse-grained material. The relation between macroscopic growth, lattice growth, and the cracking and powdering is discussed in some detail and the results used to show the reasons for apparent discrepancies in data from overseas laboratories. Information relating to the defect structure is discussed, and it is suggested that interstitial clusters in the basal planes are probably the cause of the marked anisotropy in the lattice growth. The effect of neutron energy spectrum on the damage rate is discussed and finally the potential of beryllium oxide as a reactor material is assessed. It is concluded that very fine grained material should withstand doses of at least 1 to 2×10^{21} nvt at temperatures of 500 to 1000°C without serious deterioration of properties. More information, particularly on changes of mechanical properties and thermal conductivity, is required to confirm this conclusion and to ascertain whether the material will withstand higher doses. (auth)

6735 (AE-90) SWEDISH STUDIES ON IRRADIATION EFFECT IN STRUCTURAL MATERIALS. M. Grounes and H. P. Myers (Aktiebolaget Atomenergi, Stockholm). Dec. 1962. 12p.

A brief description of work concerning the effects of neutron irradiation on structural materials is given. Some recent data are listed for the following pressure vessel steels: 2103/R3 as used in the Ågesta reactor, SIS 142103, NO345, Fortiweld, and weld metal OK 54 P. Zircaloy-2 has been studied regarding the combined effects of neutron irradiation and H content on tensile properties. The difficulties associated with determination of neutron dose and the correlation of damage with dose and neutron energy spectrum are discussed. (auth)

6736 (AFCRL-62-515) DEFECT PRODUCTION, INTERNAL FRICTION, AND YOUNG'S MODULUS IN DEUTERON IRRADIATED TUNGSTEN (thesis). Scientific Report No. 1. Daniel R. Muss (Pittsburgh. Univ.). Aug. 1961. Contract AF 19(604)-3906. 141p.

Radiation-induced defects in W are explained mathematically. The effects of 15-Mev deuterons on the mechanical properties of W are discussed. Irradiations were performed in the external beam ductwork of a cyclotron, and experiments were carried out in a cryostat capable of maintaining temperatures between 77 and 300°K. Determination of beam flux and energy is discussed. Techniques of measuring electric resistance, internal friction, and elastic modulus of W samples are detailed. The energy dependence of radiation damage in W was studied and results are given. Radiation effects on internal friction and Young's modulus, and the effects of annealing on internal friction are discussed. (R.J.S.)

6737 (ANL-6532) SWELLING OF URANIUM AND URANIUM ALLOYS ON POSTIRRADIATION ANNEALING. B. A. Loomis and D. W. Pracht (Argonne National Lab., Ill.). Sept. 1962. Contract W-31-109-eng-38. 39p.

The swelling of U and of a few selected U alloys on postirradiation annealing was investigated by utilizing density measurements in conjunction with the observation of pores in the microstructures of annealed specimens. Specimens were irradiated to about 0.3 at.% burnup in a constrained condition at approximately 275°C and were subsequently pulse annealed. The amount of swelling was found to be less than 1% for U specimens that were pulse annealed up to 75 hr at temperatures below 550°C; the amount of swelling, however, increased considerably on annealing at temperatures between 550 and 650°C. Specimens pulse annealed up to 75 hr at 618°C decreased in density by approximately 18%. The swelling was accompanied by the formation of bubbles on grain boundaries in recrystallized regions. The observations suggest that recrystallization is a necessary prerequisite for pronounced swelling in the α phase. Uranium specimens pulse annealed up to 75 hr at temperatures between 650 and 750°C in the β phase decreased in density by about 5%. Specimens annealed in the β phase, in contrast with those annealed at 618°C in the α phase, were badly cracked and contained pores of a smaller diameter, which were uniformly distributed within the grains. A specimen pulse annealed up to 16 hr at 822°C decreased in density by about 20%. This heat treatment produced pores of large diameter, located along grain boundaries, as well as pores of smaller diameter, distributed uniformly within the grains. Uranium alloys containing between 1 wt % and 9 wt % of either Ti, Zr, Nb, or Mo generally swelled more than pure U on pulse annealing up to 75 hr at 618°C and 740°C. An exception was the behavior of a U–4.0 wt % Nb alloy, which swelled less than U on annealing at 618°C. A C addition of 0.11 wt % to U substantially decreased the swelling on pulse annealing up to 75 hr at 618°C, whereas the effect of 0.02 wt % N was small; at 740°C a N addition of 0.02 wt % to U caused an appreciable increase in the swelling, but the effect of 0.11 wt % C was slight. (auth)

6738 (ASD-TDR-62-233) RADIATION EFFECTS ON SEMICONDUCTOR CATALYSTS. H. C. Sosnovosky (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Jan. 31, 1962. Contract AF33(616)-7740. 33p.

The effect of ion bombardment on carrier lifetime, photoconductivity, and surface structure of Ge (111) crystals was investigated after bombardment at voltages between 10 and 2000 v. It was found that the lifetime decreased significantly at bombarding voltages above 80 v and that the number of defects in the surface region increased simultaneously by several orders of magnitudes. These defects are most likely dislocations and vacancy clusters. Less stable defects were introduced at very low bombarding voltages, but these too were found to affect the electrical properties of the bombarded surfaces appreciably. Preliminary results of the effect of adsorbed gases on the properties of ion bombarded surfaces, and the effect of neutron bombardment on the catalytic exchange of hydrogen with deuterium on etched surfaces are included. (auth)

6739 (CVNA-153) CVTR FUEL CAPSULE IRRADIATIONS. Terminal Report. Robert N. Duncan (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Aug. 1962. For Carolinas Virginia Nuclear Power Associates, Inc., Charlotte, N. C. Contract AT(30-1)-2289. 120p.

Capsule irradiations of UO_2 fuel rods were performed to evaluate the effect of fuel rod power level on cladding dimensional changes and fission gas release. Two capsules were irradiated in the Westinghouse Test Reactor. One capsule contained three fuel rods with a 38 in. fuel length and was irradiated at peak fuel rod power levels of 17 to 19 kw/ft to a maximum fuel burnup of 3450 MWD/TmU. The other capsule contained four fuel rods with 6 in. fuel lengths. Average fuel rod power levels of over 18 kw/ft were maintained during irradiation to 6250 MWD/TmU. The Zircaloy-2 fuel rods contained sintered UO_2 pellets, 0.430 in. in dia. 94 ± 5% of theoretical density. He at 1 atm pressure was used to backfill all fuel rods except one of the 6 in. fuel rods which was initially filled with Ar. The temperature distribution within the UO_2 fuel was estimated by post irradiation measurements of the radius at which various microstructural changes such as grain growth and columnar grain formation occurred. Comparison of the UO_2 microstructures from fuel rods with initial cold diametral gaps of 0.002, 0.006 and 0.012 in. indicated that the UO_2 surface and center temperature increased with increasing gap. No evidence of UO_2 center melting was found. Diameter increases of up to 0.004 in. were measured on fuel rods with 0.002 inch initial diametral gaps. The deformation of the cladding is attributed to differential radial thermal expansion of the UO_2 fuel against the cladding. Estimates of the pellet-to-clad gap conductances indicate that dilution of the He backfill gas in the pellet-to-clad annulus occurs as the fission product gases, Xe and Kr, are released, substantially lowering the values obtained for the pellet-to-clad gap conductances. (auth)

6740 (EURAEC-380) SWELLING OF URANIUM. Quarterly Report No. 7, April 1–June 30, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucléaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 022-60-09RDB I.2.5. 13p.

Studies are reported on the determination of the character of prismatic loops produced by irradiation in metals. The method applied consists in the determination of the sign of the Burgers vector of the prismatic loops, i.e., whether they are due to vacancies or to interstitials. The material investigated was Pt in the form of thin foils irradiated by means of α-particles from boron nitride. It was the purpose of these experiments to get a better understanding of the diffraction pehnomena involved in the technique of determination, in order to perform similar experiments on U, a metal with a much more complicated structure. The dislocation loops are observed in good contrast only if the interference error is positive. This is due to effects arising from anomalous absorption of the electrons by the specimen. There is some evidence that the dislocation loops in irradiated Pt foils are due to vacancies as well as to interstitials lying in (110) planes. (auth)

6741 (GEMP-18A) HIGH-TEMPERATURE MATERIALS PROGRAM PROGRESS REPORT NO. 18, PART A. (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). Dec. 14, 1962. Contract AT(40-1)-2847. 37p.

Studies to define the pre-irradiation properties of beryllium oxide continued and additional data were obtained on elastic constants, strength, thermal stability, and compressive creep. Irradiation tests continued and additional data were obtained on lattice parameters, dimensional and volume expansion, strength, and creep of irradiated specimens. Non-radiation results include a summary of the elastic constant data in terms of the influence of porosity, preferential orientation, and temperature. The moduli of elasticity in the directions normal and parallel to the basal plane were computed from polycrystalline data. Post-irradiation measurements indicate that specimens of 5-μ grain size retained about 25% of their unirradiated strength in irradiations at 600°C to a dosage of 1.5×10^{21} nvt (≥1 Mev). Comparable reduction in strength occurred in larger grain size materials at as little as one-fifth this dosage. Gas bubbles were observed in a specimen irradiated at 1000°C to 3.4×10^{20} nvt (≥1 Mev). (auth)

6742 (HW-SA-2309) EXTENSIVE MOVEMENT OF FISSION FRAGMENTS AND PLUTONIUM DEMONSTRATED IN UO_2 IRRADIATION TESTS. J. L. Bates, J. A. Christensen, and W. E. Roake (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 6, 1961. Contract [AT(45-1)-1350]. 9p.

It is noted that evaluation of the useful life limit of UO_2 as a nuclear fuel depends to a large extent on knowledge of lattice-damaging fission fragments and of the second generation fissionable atom locations. Recent experimental results show extensive relocation of several fission products and Pu in high-rate UO_2 fuels. These movements from the point of view of fission energy expenditure are presumably accomplished by diffusion, by void migration, or by vaporization of the fission fragments and redeposition in cooler portions of the fuel. (J.R.D.)

6743 (HW-SA-2445) DISTORTION OF HELICAL WIRE WRAPPINGS. K. R. Merckx (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 22, 1962. Contract [AT(45-1)-1350]. 5p.

One method of separating cylindrical rods in cluster fuel elements is by helical wound wires on alternating elements. Since irradiation of reactor fuel materials can cause dimensional changes in the fuel rods, the helical wire wraps may tighten or separate from the fuel rod. Equations are presented describing the deformations and forces acting on the helical wire wrapping in terms of the dimensional changes of a fuel rod. (auth)

6744 (HW-SA-2668) IRRADIATION TESTING OF PROTOTYPIC UO_2–PuO_2 PRTR FUEL ELEMENTS. M. D. Freshley (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 8, 1962. Contract AT(45-1)-1350. 22p.

Irradiation tests of prototypic fuel elements containing UO_2-PuO_2, in which considerable PuO_2 segregation exists, showed that such elements can be operated satisfactorily under PRTR conditions. Micro-scale homogenizing of PuO_2 enrichment heterogeneities in UO_2 occurs in regions of high fuel temperatures. Complete in-reactor homogenizing of gross PuO_2 segregation in UO_2 does not occur. The operating limits of such a fuel element are governed by the degree and location of enrichment segregation within the fuel material; excessive core-clad interface temperatures result in damage to the cladding and could cause burnout. Incrementally loaded UO_2-PuO_2 fuel elements are performing satisfactorily in the PRTR. (auth)

6745 (HW-SA-2675) IRRADIATION OF UO_2-PuO_2 CAPSULES. W. J. Bailey and T. D. Chikalla (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 8, 1962. Contract AT(45-1)-1350. 20p.

The objectives were to determine the effect of PuO_2 content on the radiation stability of UO_2-PuO_2, to compare the performance of fuel cores prepared with coprecipitated UO_2-PuO_2 to those with mechanical mixtures of UO_2-PuO_2, and to investigate in-reactor sintering of low density UO_2-PuO_2. (auth)

6746 (MRL-126) THE ROLE OF ELECTRON MICROSCOPY IN OBSERVATIONS OF RADIATION DAMAGE. Allen N. Goland (Watertown Arsenal. Materials Research Lab., Mass.). Nov. 1962. 10p.

Radiation-damage theories predict that a variety of defects will be produced in a solid during nuclear bombardment. The spacial extent of some of these defects is within the resolving power of the modern electron microscope. The theories and their relation to electron-microscopic observations of radiation-induced defects are summarized. (auth)

6747 (NP-12364) EFFECTS OF NUCLEAR RADIATION IN A LIQUID HYDROGEN MEDIA. Quarterly Report No. 2, April 1, 1961–June 30, 1961. PART I. CRYOGENIC APPARATUS FOR A LIQUID HYDROGEN IONIZATION FLOW CHAMBER. J. C. Drobinski, Jr. PART II. COLLECTION BETWEEN PARALLEL PLATES OF IONIZATION PRODUCED BY NUCLEAR RADIATION IN FLOWING CRYOGENIC MEDIA. A. Thomas (Tracerlab, Inc., Waltham, Mass.). Contract NASr-20. 33p.

A cryogenic apparatus for a liquid hydrogen ionization flow chamber, and the collection between parallel plates of ionization produced by nuclear radiation involving cryogenic media were investigated. A flow system was designed to measure the mobilities of the ions in liquid H as well as indirectly obtain the recombination coefficients of the ions. The mobility and recombination characteristic of the ions will be studied by the use of a pyrex "U" tube completely immersed in liquid H and housing a shafted propeller to pull the liquid H continuously through the tube and a pitot tube, the design of which is based on M.I.T. wind tunnel experience. Propeller tests in water and liquid Ni demonstrate that linear velocities of 0–6 cm/sec with a maximum shaft speed of 2200 rpm can easily be attained by the pyrex "U" tube. The pitot tube is used when higher velocities are desired. The radiation source for the liquid H flow chamber will probably be Kr^{85}. After the Kr^{85} source has been tested and evaluated, 400μ Sr^{90} microspheres will be investigated thoroughly as a possible ionization source. The H flow chamber or detector is a split plate ionization unit. A theoretical study of this H flow (split plate) ionization chamber was made by applying theoretical models to experimental situations being planned. The following effects were studied: effect of space charge on the field and on the ion trajectories, processing data at different source-detector spacings based on an effective distance between source and ion chamber, processing data at different source-detector spacings based on an effective source position and on an ion chamber of finite length, and separate measurements of positive and negative ion mobility. Results of these studies indicate that space charge will not appreciably affect the values to be obtained for ion mobilities and ion recombination coefficient in liquid H. Two methods for processing the data were formulated to yield $(\alpha/\mu^+ + \mu^-)$. An experiment for measuring μ^+ and μ^- separately was described and analyzed. The ion currents in all experiments appear to be of measurable magnitude. (auth)

6748 (ORNL-3340) IRRADIATION EFFECTS ON UC_2 DISPERSED IN GRAPHITE. Final Report. J. G. Morgan and M. F. Osborne (Oak Ridge National Lab., Tenn.). Jan. 8, 1963. Contract W-7405-eng-26. 62p.

Postirradiation examinations were performed on four fuel cylinders containing UC_2 dispersed in graphite and sealed in low permeability graphite cans irradiated in the MTR. In all but one experiment, a flowing stream of He passed over the outside of the graphite cans. The estimated fuel cylinder central temperatures ranged from 2500 to 3500°F, and the maximum U^{235} burnup was 21%. The most important radiation effects were fuel dimensional change, fission product and U migration, and microscopic structural changes. The fuel cylinders, in general, decreased in diameter and increased in length. The decrease in diameter was a function of fuel burnup. A 4.5% decrease in diameter was observed at a burnup of 6×10^{19} fissions/cm^3 of fuel dispersion. Uranium had migrated out of the fuel cylinders into the graphite cans. Fission products likewise were found throughout the walls of the graphite can, with steep concentration gradients near the inside surface of the can wall. The isotopes Zr^{95} and Ce^{144} were more abundant near the outside wall surface than at midwall. There was no corresponding rise in the concentrations of Sr^{90} and Cs^{137} near the outside surface. Microstructural changes were observed in the UC_2 particles which were a function of burnup. At around 4 at.% U burnup the particles became porous and began to lose their angular shape. At 21 at.% U burnup, the particles had spheroidized and had begun to diffuse into the surrounding graphite matrix. (auth)

6949 (TID-15542) ELECTRON SPIN RESONANCE OF RADIATION PRODUCED DEFECTS IN DOPED QUARTZ. John A. Weil (Argonne National Lab., Ill.) and John A. Anderson (Pittsburgh. Univ.). Jan. 1962. Contract [W-31-109-eng-38]. 4p. (UAC-6032)

Studies are reported concerning color centers in naturally occurring rose quartz. No electron paramagnetic resonance (EPR) spectrum was observable in virgin samples. However, after x-irradiation, room temperature EPR spectra occurred. At liquid nitrogen temperature, a new center was identified and labeled as the D center. It is probable that the D center is the titanium analog of centers associated with alkali nuclei. (R.J.S.)

6750 (TID-17382) RADIATION DAMAGE TO NON-METALLIC MATERIALS. V. P. Calkins (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Mar. 30, 1954. Contract [AT(11-1)-171]. 42p.

Radiation damage to covalent compounds, such as organics, by pile radiation is due primarily to secondary ionization caused by fast neutrons, slow or thermal neutrons, and gamma rays, and is not due directly to the initial interaction of any of these three types of radiation with the

nuclei or atoms of the organic compounds. Since ionic compounds are already ionized, pile radiation causes very little damage due to ionization. In the case of fast neutrons, some damage is caused to ionic compounds by collision of neutralized recoil ions with the atoms of the compound; this causes displacement of atoms within the crystal lattice and is known as the Wigner effect. The existing available data on radiation damage have been examined and, on the basis of calculated energy absorption values, broad generalizations have been made regarding the estimated radiation damage thresholds of various components of a typical nuclear power plant. (R.J.S.)

6751 (TID-17406) QUANTITATIVE HARDNESS OF IRRADIATED AND NONIRRADIATED DIAMOND. Final Report. R. M. Denning (Michigan. Univ., Ann Arbor. Coll. of Literature, Science, and the Arts). Nov. 1962. Contract AT(11-1)-760. 68p. (ORA-03041-2-F)

The grinding hardness of larger single crystal diamonds in selected crystallographic directions as a function of the amount of fast neutron irradiation was investigated, particularly at lower levels of irradiation. Ultraviolet and infrared absorption, density, x-ray diffraction, piezobirefringence, cleavage surfaces, and electron spin resonance were also studied. (R.J.S.)

6752 (WAPD-264) THE IRRADIATION BEHAVIOR OF ZrO_2-UO_2 FUELS. B. F. Rubin, R. M. Berman, and M. L. Bleiberg (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 1962. Contract AT-11-1-GEN-14. 221p.

Plate-type fuel elements containing ZrO_2-UO_2 fuel with a wide range of UO_2 loadings were tested in pressurized hot water loops over a range of surface heat flux values, and the in-pile behavior of these elements was determined. The ZrO_2-base fuels were found to be extremely plastic in-pile and to undergo densification to essentially 100% theoretical density very shortly after the beginning of exposure. Irradiation-induced phase changes were observed by x-ray diffraction, with multiphase compositions homogenizing into a single, metastable phase with the fluorite-type structure. Fission gas precipitates internally as bubbles, beginning at an early stage of irradiation. The in-pile fuel swelling is linear with exposure, after correction for initial densification, up to 40×10^{20} fissions/cc and was determined to be 0.7% ΔV per 10^{20} fissions/cc for compositions between 25 and 46 wt% UO_2 and temperatures between 1300 and 2300°F. (auth)

6753 (WAPD-T-1402) IRRADIATION-INDUCED PHASE CHANGES IN ZrO_2-UO_2 FUELS. R. M. Berman and B. Rubin (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Aug. 1961. Contract AT(11-1)-Gen-14. 11p.

After comparatively small amounts of neutron irradiation, multiphase mixtures in the ZrO_2-UO_2 binary system combine into a single phase. Above 6×10^{20} fissions/cc, this single phase is cubic. This cubic phase is apparently continuous from UO_2 to ZrO_2. The cell edge varies linearly with molar composition, but not significantly with radiation exposure. It is postulated that there exists a high-temperature cubic phase which cannot be quenched using ordinary furnace techniques at compositions with less than 70 wt% UO_2. (auth)

6754 (FTD-TT-62-719) ON THE STRENGTH OF THICK-WALLED CYLINDRICAL AND HOLLOW SPHERICAL SHELLS EXPOSED TO IRRADIATION. A. A. Il'yushin and P. M. Ogibalov. Translated from Inzh. Sb., 28: 134-44(1960). 18p.

The changes in volume and in the elastic and plastic characteristics of a homogeneous isotropic body subjected to neutron irradiation are set forth mathematically. (R.J.S.)

6755 EFFECTS OF BURNUP ON CERTAIN CERAMIC FUEL MATERIALS. M. L. Bleiberg, W. Yeniscavich, and R. G. Gray (Bettis Atomic Power Lab., Pittsburgh). Am. Soc. Testing Mater., Spec. Tech. Publ., 306: 64-85(1961). (WAPD-T-1274)

The effect of irradiation in pressurized hot-water loops on bulk UO_2, UO_2 dispersed in BeO, and UO_2 dispersed in Al_2O_3 are compared. It is shown that when UO_2 is irradiated to high exposures, the material increases in volume, and increased amounts of fission gases are released. In addition to this effect in BeO and Al_2O_3, swelling occurs as a result of fission fragment destruction of the matrix phase. The parameters influencing this behavior are discussed. (auth)

6756 OPERATION OF A SUPERCONDUCTING SOLENOID IN A 400-Mev PROTON FLUX. R. Babcock and H. Riemersma (Westinghouse Electric Corp., Pittsburgh). Appl. Phys. Letters, 1: 43-4(Oct. 1962).

The possibility of using superconductors in various applications to effect savings in power used and size of equipment requires knowledge on the effects of particle absorption in the solenoid. A solenoid of 75% Nb–25% Zr wire is bombarded with 440-Mev protons and brought into superconduction. Normal conduction is found to result from deliberate raising of current, never from interactions producing heat spikes that cause transition to the normal state. (D.C.W.)

6757 DIRECT OBSERVATION OF NEUTRON DAMAGE IN GERMANIUM. J. R. Parsons, R. W. Balluffi, and J. S. Koehler (Univ. of Illinois, Urbana). Appl. Phys. Letters, 1: 57-8(Nov. 1962).

Results of earlier experiments indicate that neutrons and deuterons produce defect regions in germanium in the range 30 to 100 Å. An attempt is made to observe similar defects by electron microscopy since 2-3 Mev electron irradiation produces no defects. Thin germanium films were irradiated, and an increase in the number of defects was observed with neutron flux. Results compare favorably with other determinations. (D.C.W.)

6758 RADIOCRYSTALLOGRAPHIC STUDY OF HIGHLY RADIOACTIVE MATERIALS. J. Bloch (Commissariat à l'Énergie Atomique, Saclay, France). Bull. Soc. Franc. Mineral. Crist., 84: 281-6(July-Sept. 1961). (In French)

In the Laboratoire d'Examen des Combustibles Irradiés at Saclay a hot cell is designed for the radiocrystallographic analysis of irradiated fuel elements. It is equipped with an apparatus using the double-diffraction method: an aluminum monochromator is placed in the beam of x rays diffracted by the sample, which permits a lead shield to be interposed between the sample and the counter. The radiation due to the radioactivity of the sample is thus eliminated to a very great proportion. Some results obtained on highly irradiated materials (evidence of some phase present), where the continuous background due to the radioactivity remains below 5 counts/sec, and the results of a study of the parameter variation on weakly irradiated materials (the relative precision obtained for these measurements is 0.8×10^{-4}) are cited as examples. (tr-auth)

6759 OBSERVATION BY X-RAY TOPOGRAPHY OF THE DAMAGE CAUSED BY IRRADIATION WITH PROTONS. André Authier and Pierre Lallemand (Laboratoire de Mineralogie-Cristallographie, Sorbonne, Paris). Compt. Rend., 255: 967-9(July 30, 1962). (In French)

The Lang method was used to study a silicon crystal in which certain regions had been irradiated by protons. It was ascertained that the irradiated zones are very disturbed by x rays. It is possible to show that the perturbation can be extended to the entire thickness of the crystal even when the penetration of the protons is only 15 μ. (tr-auth)

6760 EFFECT OF THE IRRADIATION TEMPERATURE ON THE ELECTRIC CONDUCTIVITY OF LITHIUM FLUORIDE IRRADIATED WITH NEUTRONS. Georges Blanc, Pierre Berge, Monique Dubois, and Mireille Benveniste (Centre d'Etudes Nucleaires, Saclay, France). Compt. Rend., 255: 1502-4(Sept. 24, 1962). (In French)

Monocrystals of LiF were irradiated with neutrons at temperatures between –196°C and room temperature in order to study temperature transition effects. It was determined that the transition temperature lies between –50 and –20°C. (tr-auth)

6761 A METALLOGRAPHIC STUDY OF SWELLING IN ALPHA-PARTICLE IRRADIATED ALUMINUM AND ALUMINUM ALLOYS. A. Boltax (Westinghouse Electric Corp., Pittsburgh). J. Nucl. Mater., 7: 1-15(Sept.-Oct. 1962). (In English)

The behavior of helium in aluminum and aluminum alloys was studied by metallographic examination of samples irradiated with alpha particles and subsequently annealed. The post-irradiation anneal produces a 2 mil wide band of helium bubbles approximately 15 mils below the surface of the sample. The appearance, size, and density of the helium bubbles were studied as a function of post-irradiation heat treatment. The results indicate that the swelling resistance of aluminum at 400 and 550°C is not improved by alloying. Also, quantitative measurements of swelling showed that surface tension is the dominant restraint to swelling when the gas bubble radii are smaller than one micron. (auth)

6762 AN X-RAY METHOD FOR PREDICTING ANISOTROPIC IRRADIATION GROWTH IN URANIUM. E. F. Sturcken and W. R. McDonell (E. I. du Pont de Nemours & Co., Aiken, S. C.). J. Nucl. Mater., 7: 85-91(Sept.-Oct. 1962). (TID-14322). (In English)

A single quantitative parameter for description of preferred orientation was developed for correlation with anisotropic irradiation growth in uranium. The parameter is derived from x-ray diffraction measurements of the type heretofore described by inverse pole figures. The new parameter, called the growth index, GI, formed a smooth curve when plotted against dimensional changes in alpha-rolled uranium plate that had been irradiated to 600 MWD/T (0.077 at. % burnup) in the Materials Testing Reactor (MTR). The growth index is formulated by weighting the volume of grains in each orientation by a strain tensor for anisotropic growth. Interactions between grains are neglected as a first approximation. The assumption of a tensor weighting factor is based on the observed homogeneous deformation of uranium at constant volume and does not depend on the mechanism by which deformation might occur. The growth index gives a single quantitative value for a given preferred orientation; with this information, controlled irradiation experiments can be performed on other variables that affect anisotropic growth such as fabrication methods, heat treatment, fuel geometry, cladding restraint, neutron flux, burnup, and irradiation temperature. (auth)

6763 COMPARISON OF ELECTRON-MICROSCOPE OBSERVATIONS IN NEUTRON-IRRADIATED COPPER AND GOLD. A. N. Goland (Brookhaven National Lab., Upton, N. Y.). J. Nucl. Mater., 7: 101-2(Sept.-Oct. 1962). (BNL-5925). (In English)

Electron microscope observations of neutron-irradiated Cu and Au indicate two differences in the nature of the damage: the average spot diameter remains constant in Au but increases in Cu with increasing exposure; and the spot density increases more rapidly with integrated neutron flux in Au than in Cu. Brinkman, et al., (J. Nucl. Mater., 4: 332(1961)) have recently contended that the observations are incompatible with a single model of spot production. The author points out that the observations can be explained by defect migration and agglomeration, and that certain experimental facts are in accord with such a model. (W.D.M.)

6764 MOLECULAR WEIGHT DISTRIBUTION OF IRRADIATED POLYMERS. Tôsaku Kimura (National Science Museum, Ueno Park, Japan). J. Phys. Soc. Japan, 17: 1884-90(Dec. 1962). (In English)

The molecular weight distribution of irradiated polymers is calculated numerically by means of serial solutions of integro-differential equations in relation to crosslinking with or without degradation. The change in shape of this distribution as a function of radiation dose is also discussed. It is shown that the maximum value of the weight fraction decreases with increasing radiation dose when crosslinking exceeds degradation. However, when degradation exceeds crosslinking, the maximum value increases with increasing radiation dose. The degree of polymerization corresponding to the maximum value, however, always decreases, regardless of whether crosslinking exceeds degradation. If the initial molecular weight distribution is nearly uniform, a peak appears at twice the value of the initial degree of polymerization as a result of radiation dimerization. (auth)

6765 ON INTERSTITIAL DISLOCATION LOOPS IN ALUMINIUM BOMBARDED WITH ALPHA-PARTICLES. D. J. Mazey (Atomic Energy Research Establishment, Harwell, Berks, Eng.), R. S. Barnes, and A. Howie. Phil. Mag. (8), 7: 1861-70(Nov. 1962). (AERE-R-4087)

Electron transmission microscopy and selected area diffraction have shown that the dislocation loops in aluminum bombarded with 38 Mev alpha-particles lie generally upon the {110} planes with a [110] Burgers vector normal to the loop. These loops are only seen where the alpha-particles come to rest. The theory of diffraction contrast at dislocations has been used to determine the sense of the Burgers vectors and shows that the loops are formed from interstitial atoms as previously inferred from their annealing behavior. (auth)

6766 THERMOELECTRICITY IN IRRADIATED GLASS. Fred C. Hardtke (Argonne National Lab., Ill.). Phys. Rev. Letters, 9: 339-41(Oct. 15, 1962).

Thermally released charge displacements occurring in the absence of any externally applied electric field have been reported previously for gamma- and x-irradiated glasses. Preliminary studies are described in which room-temperature irradiations of Cabal-type glasses with Co^{60} have been found to induce a similar effect when the irradiated samples are heated subsequently in temperature gradients of 20 to 40°C/mm. A typical displacement current measurement is given along with the influence of temperature gradient on charge displaced Q. Metal foils interposed between the source and sample greatly reduce the magnitude of Q. The effect of shield thickness on Q and extrapolated ranges for various shields are shown. Irradiations with 1 Mev Van de Graaff electrons produce similar charge displacements, but at much lower doses. (H.D.R.)

6767 ENERGIES OF PHOTOIONIZATION AND THERMAL IONIZATION OF THE DEEP LEVELS OF RADIATION DEFECTS IN SILICON. V. S. Vavilov, G. N. Galkin, V. M.

Malovetskaya, and A. F. Plotnikov (Lebedev Inst. of Physics, Moscow). Soviet Phys.-Solid State (English Transl.), 4: 1442-3(Jan. 1963).

The complexity of the spectra of radiation defects in Si and the presence of a system of closely spaced levels makes it difficult to identify these levels and compare unambiguously the results to Hall and photoelectric measurements. The results of a comparison of such measurements are given using the recently discovered difference in the annealing stability of two closely spaced energy levels of centers produced by irradiation with fast electrons. (W.D.M.)

6768 DEISTVIE OBLUCHENIYA NA METALLY I NEKOTORYE TUGOBLAVKIE MATERIALY. (Radiation Effects on Metals and Other High Melting Materials). V. V. Pen'kovskii. Kiev, Ukrainian SSR, Publishing House of the Academy of Sciences, 1962. 184p.

Radiation effects of neutrons and other elementary particles on various metals and high-melting materials are described. Structural changes; phase transformation; and electric, optic, magnetic, and other changes taking place in the irradiated materials are discussed. A survey is made of high melting point materials with high resistance to irradiation for use in reactors. The boon was designed for specialists in solid state physics, metal physics, and technology of high-melting compounds. 500 references are included. (R.V.J.)

6769 IMPROVEMENTS IN OR RELATING TO THE CURING OF SILICONES BY IRRADIATION. Cyril John Baker, Raymond Leslie Bass, William Henry Thomas Davison, and Dewi Gerwyn Lloyd (to Midland Silicones Ltd.). British Patent 912,259. Dec. 5, 1962. Filed Apr. 22, 1959.

Cured or cross-linked polysiloxanes are produced by irradiating an organopolysiloxane in which at least 0.5% of the substituents attached to the silicon atoms of the siloxane chain are unsaturated hydrocarbon radicals and/or hydrogen atoms. The quantity of high-energy radiation employed is insufficient to cause immediate gelation but sufficient to cause gelation by cross-linking after a time delay. The material may then be deformed to form an object between irradiation and gelation. (R.J.S.)

6770 RADIATION-RESISTANT LUBRICANTS AND THEIR USE. Neville John Hunter and Derek Illing (to British Petroleum Co. Ltd.). British Patent 913,411. Dec. 19, 1962. Filed Jan. 29, 1960.

A radiation-resistant lubricating oil is prepared by reacting a terphenyl with a straight-chain olefin or a primary or secondary alkyl halide having, in either case, 1 to 20 carbon atoms per molecule. (R.J.S.)

PHYSICS

General and Miscellaneous

6771 (AD-276005) THERMOELECTRIC MATERIALS. Final Report, January 4, 1960–July 3, 1961. (Transitron Electronic Corp., Wakefield, Mass.). Contract NObs-78345. 42p.

As a practical result of the contractual work, an N-type thermoelement CoSi + 1% FeSi and a P-type thermoelement $Cr_{0.05}Mn_{0.95}Si_2$ + 2% Ag were developed. These materials, like most of the transition metal silicides, are stable thermally. Bonding experiments suggest that the bonding of electrical contracts to the transition metal silicides is by no means an insuperable problem. It is suggested that the silicides will be useful in the range 500 to 800°C probably in cascade with PbTe. On the theoretical side, a basic understanding of the transition metal silicides or, indeed, any of the transition metal compounds is still lacking. The silicides remain as one of the few stable materials at high temperatures. Much could be done to optimize the transition metal silicides still further, particularly, along the lines of addition of small quantities of noble metals and the reduction of the lattice component of the thermal conductivity by substitutions of heavy metal silicides. (auth)

6772 (AD-276597) LONG LIFE CLOSED LOOP MHD RESEARCH AND DEVELOPMENT UNIT. Interim Scientific Report No. 1, March 15, 1962–June 15, 1962. (Westinghouse Electric Corp. Research Labs., Pittsburgh). June 11, 1962. Contract AF33(657)-8311. 87p.

The problem areas peculiar to closed-loop operation of an MHD generator were investigated. The closed-loop consists of essentially an MHD motor-generator set. The MHD motor circulates the gases within the closed-loop and the MHD generator abstracts some electrical energy from the flowing stream. The major advantage of the closed-loop is that it can be operated economically under steady long term operating conditions, thereby affording sufficient time for careful investigation of the state of the gas, the potential distribution, the current and power distribution, the leakage currents, the behavior of the sidewall and electrode materials, and the effects of operating parameters on performance of both the motor and generator sections. (auth)

6773 (AFCRL-62-751) RATE OF IONIZATION BEHIND SHOCK WAVES IN AIR. II. THEORETICAL INTERPRETATION. Research Report No. 115. S. C. Lin and J. D. Teare (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Sept. 1962. Contract AF19(604)-7458. 67p.

The problem of spontaneous ionization (i.e., no externally applied electromagnetic fields, nor hard radiation) in the reaction zone behind strong normal shock waves in air was treated concurrently with the problem of dissociation and vibrational relaxation. Through a comparison of specific ionization rates, it may be concluded that up to a shock velocity of 10 km/sec (about 30 times the speed of sound at room temperature) the predominant electron production process is atom-atom ionizing collisions. This is followed in an approximately decreasing order of importance by photoionization, electron impact, atom-molecule collisions and molecule-molecule collisions. The charge exchange reactions, while not contributing directly to the electron production process, were found to have a small but noticeable indirect effect on the resultant electron density distribution at some distance behind the shock due to their continuous shifting of the relative population between atomic and molecular ions (which recombine with the electrons at different rates). The specific rate constants for the atom-atom processes required to interpret all existing experimental results appear to be consistent with a simple extrapolation of the low temperature rate constants according to the crossing-point model of Bates and Massey for atom-atom ionizing collisions. (auth)

6774 (AFCRL-531(I)) CHAPTER I. COLLISION CROSS SECTIONS. CHAPTER II. ATOMIC SCATTERING PROCESSES. Edward Gerjuoy. CHAPTER III. HIGH RESOLUTION GROUND BASED SIMULTANEOUS MEASUREMENT OF IONOSPHERIC ELECTRON DENSITY AND COLLISION FREQUENCY. Final Report, Part I. Frances Richey and R. S. Wehner (Plesset (E. H.) Associates, Inc., Los Angeles). Jan. 30, 1961. Contract AF19(604)-6187. 132p. (AD-275509)

A review is presented concerning the formal theory used to compute reaction rates resulting from arbitrarily complicated collisions between aggregates of spinless distinguishable particles with special reference to atomic and molecular collisions. A review of developments during the last three years in the technology of atomic collision processes is also included along with results of investigations concerning simultaneous measurement of electron density and collision frequency in the upper atmosphere using a combination of back-scattered radar return and cross modulation techniques. (J.R.D.)

6775 (ANL-6603) PHYSICS DIVISION SUMMARY REPORT, JULY–AUGUST 1962. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 94p.

The information is summarized in 8 sub-sections. Separate abstracts were prepared for 6 of the sub-sections. The sub-sections for which no abstracts were prepared contain information on preacceleration in electron theory and spin and statistics with an indefinite metric. (J.R.D.)

6776 (ANL-6603(p.1-8)) GAMMA-RAY SPECTRA FROM CAPTURE IN NEUTRON RESONANCES. H. E. Jackson (Argonne National Lab., Ill.).

The capture gamma-ray spectra of resonances in Mo^{95} below 1200 ev were studied in an effort to make unambiguous identification of individual resonances resulting from capture of p-wave neutrons. Such resonances at 107, 215, 330, and 1010 ev were identified on the basis of unique features of their capture spectra. (auth)

6777 (ANL-6603(p.9-19)) NEUTRON POLARIZATION AND DIFFERENTIAL CROSS SECTIONS. A. J. Elwyn, R. O. Lane, and A. Langsdorf, Jr. (Argonne National Lab., Ill.).

The polarization and differential cross section for neutrons scattered from deuterium are measured at five angles for incident neutron energies at 0.5, 1.0, and 1.95 Mev. The neutrons were produced in the $Li^7(p,n)Be^7$ reaction. The partially polarized beam emitted at 51° was used first directly and then with the spins precessed through 180° in the transverse field at an electromagnet in order to determine the asymmetry in the intensities after scattering from deuterium. The results at 0.5 and 1.0 Mev give zero polarization in the n-d scattering within 2 to 3%. At 1.95 Mev small positive polarizations up to 4% are observed. The differential cross sections meas-

ured are peaked more toward large angles than in some earlier work. These data are compared with earlier calculations and a new phase-shift analysis of the present measurements is made. (auth)

6778 (ANL-6603(p.20-46)) NUCLEAR RESONANCE ABSORPTION OF GAMMA RAYS. R. S. Preston, S. S. Hanna, and J. Heberle (Argonne National Lab., Ill.).

The Mössbauer effect in metallic iron was studied at 4 to 1300°K. The internal field at the nucleus, the shift in excitation energy between source and absorber, and the strength of the resonant absorption were measured as functions of the temperature. (auth)

6779 (ANL-6603(p.47-52)) EXCITED STATES OF LIGHT NUCLEI. J. A. Weinman, L. Meyer-Scheutzmeister, and L. L. Lee, Jr. (Argonne National Lab., Ill.).

The $O^{18}(\alpha,n)Ne^{21}$ reaction was investigated for $1.40 < E\alpha < 2.73$ Mev. The resonant energy and total width of several resonances are reported. (auth)

6780 (ANL-6603(p.52-5)) STUDIES OF PICKUP REACTIONS. T. H. Braid and B. Zeidman (Argonne National Lab., Ill.).

The (d,t) reactions of 21.6-Mev deuterons on V, Cr, Mn, Fe^{54}, Fe^{56}, and Ni^{58} were studied over a range of forward angles. In nuclei with N = 28, the presence of several strong l = 3 transitions indicates wave functions with mixed seniority. In nuclei with N = 30, l = 1 transitions also appear. (auth)

6781 (ANL-6603(p.57-73)) CONSECUTIVE ION-MOLECULE REACTIONS. (Argonne National Lab., Ill.).

Some of the principal ionic intermediates in the "Wilzbach labeling" of methane by T_2 were identified. The long-lived transient $C_2H_4T^+$ takes part in the decay-induced mechanism and that part of the radiation-induced mechanism starting with T_2^+. The shapes of the ionization efficiency curves of primary and secondary ions of N_2, O_2, CO_2, and Ar were studied. No evidence was found for primary precursors in optically-forbidden states, in contrast to recently published work. (auth)

6782 (ANL-6611) BENDING-MAGNET AND QUADRUPOLE ABERRATIONS FOR PARAXIAL RAYS. M. L. Good (Argonne National Lab., Ill.). Nov. 1962. Contract W-31-109-eng-38. 17p.

Aberrations of bending magnets and quadrupoles for paraxial rays are discussed, with particular emphasis on isolating those effects likely to be of practical importance in high-energy separated beams. (auth)

6783 (BSD-TDR-62-337) THE MAGNETOHYDRODYNAMICALLY SUPPORTED HYPERSONIC SHOCK LAYER. Research Report 140. R. H. Levy and H. E. Petschek (Avco Corp. Avco-Everett Research Lab.). Sept. 1962. Contract AF04(694)-33. 43p. (AD-290786)

The two-dimensional problem of the interaction of a hypersonic flow with the field of a current carrying wire is analyzed. The electrical conductivity behind the normal shock is taken to have an arbitrary finite value, while the free stream conductivity is zero. It is found that the magnetohydrodynamically supported shock wave follows the magnetic field lines closely and that the hot flow is confined to a narrow region behind the shock at all values of conductivity. For low conductivities the shock position is determined by setting the interaction parameter based on the velocity behind the normal shock and a distance of ϵ times the shock radius equal to $[1 + (2\epsilon)^{1/2}]/3$ where $\epsilon(\ll 1)$ is the density ratio across the shock. The high conductivity case is reached when the magnetic Reynolds number, based on the above parameters, exceeds unity. The shock position is then determined by equating the dynamic and magnetic pressures. The thickness of the current sheet in this case is of the order of the shock radius divided by $R_m^{1/2}\epsilon^{-1/4}$. For low conductivities the case of a wire embedded in a solid cylinder has also been considered, and it is shown that the heat transfer is reduced sharply when the shock wave is lifted off of the surface of the cylinder. (auth)

6784 (CERN-62-30) SUPER-CONDUCTIVITY AND THE QUANTIZATION OF MAGNETIC FLUX. V. F. Weisskopf (European Organization for Nuclear Research, Geneva). Oct. 10, 1962. 23p.

The concept of a super-current as opposed to an ordinary current and its close interrelation with magnetic fields are discussed. Topics covered include: metallic conduction, the compact distribution, magnetic field and current, conducting cylinder in magnetic field, superconducting ring in a magnetic field, the quantization of magnetic flux, and the stability of the super-current. (M.C.G.)

6785 (CERN-62-31) THE MAXIMUM LIKELIHOOD METHOD APPLIED TO THE DETERMINATION OF THE BEST VALUE FOR THE PRIMARY IONISATION IN TRACK CHAMBERS. R. D. Fortune (European Organization for Nuclear Research, Geneva). Oct. 16, 1962. 11p.

The basis of a computer program for analysis of ionization measurements and the way in which the program may be used to give the "best value" of the ionization and the error from gap counts obtained with a logarithmic reticule are described. Methods of measuring primary ionization are discussed. The maximum likelihood method is outlined. The computer program is described. (M.C.G.)

6786 (DCAS-TDR-62-133) THE GOVERNING MACROSCOPIC EQUATIONS OF PARTIALLY IONIZED GASES. D. M. Dix (Aerospace Corp. Physical Research Lab., El Segundo, Calif.). July 25, 1962. Contract AF04(695)-69. 44p. (TDR-69(2230-04)TN-2).

Useful formulations of the macroscopic conservation relations for a three-component mixture composed of ions, electrons, and neutral particles were developed from the basic forms of the equations for the individual species. The development represents primarily a compilation of the work of previous investigators, although the equations developed are somewhat more general than those previously derived. In particular, all inertial and viscous terms are retained, and the temperatures of the individual species are not required to be equal. In addition, treatment of the energy equations is included. (auth)

6787 (EANDC(E)-36L) THE ISOTOPIC COMPOSITION OF SAMPLES, ORIGINATING FROM DIFFERENT STOCKS OF BORON STANDARD, USED IN LABORATORIES OF THE EANDC-AREA AS BASES FOR NEUTRON MEASUREMENTS. G. H. Debus (European Atomic Energy Community). Aug. 1962. 4p.

Results of comparative studies on the isotopic composition of natural B samples used by various research groups as standards are presented. The samples were obtained from Argonne, Fontenay, and the Euratom Central Bureau for Nuclear Measurements. (J.R.D.)

6788 (EDR-2791) INVESTIGATION OF THE MONO-CAPILLARY THERMIONIC EMITTER AS A DUAL SOURCE OF IONS AND ELECTRONS. Quarterly Technical Progress Report No. 2, February 15–May 15, 1962. D. L. Dresser and W. Laurita (General Motors Corp. Allison Div., Indianapolis). May 15, 1962. Contract AF33(616)-8299. (AD-275733)

Theoretical and experimental work is reported on the investigation of a capillary emitter serving as a dual source

of ions and electrons in a thermionic converter. During this report period, improved agreement was achieved between the experimental data obtained on monocapillary test devices and a model based on the sheath potential concept. Several processes for fabricating multicapillary emitters are described, including stacking fine wires, spark machining, electrolytical etching, vapor deposition, and electrochemical deposition. Experimental results are given to show the feasibility of circulating Cs by means of an electromagnetic pump. The design and fabrication of a closed cycle (gravity feed) multicapillary thermionic converter are discussed. (auth)

6789 (ERDL-1704-RR) EXO-ELECTRON EMISSION AND RELATED ELECTRON EMISSIONS (A REVIEW OF THE PRESENT STATE OF THE ART). Herbert J. Mueller (Army Engineer Research and Development Labs., Fort Belvoir, Va.). Dec. 20, 1961. 87p. (AD-276213)

Many solids emit electrons after excitation by energy interaction, by plastic deformation, or during phase transitions. These electron after-currents are usually very small, and their intensity decreases with progressing time after the excitation. The phenomenon is known as exo-electron emission, Kramer-effect, delayed electron emission, or electron after-current. The experimental results available so far are reported, and their sometimes controversial interpretations are discussed. The review is based on a complete literature survey of this topic. (auth)

6790 (HW-SA-2405) IN-PLACE MEASUREMENT OF PERMEABILITY IN HETEROGENEOUS MEDIA. PART III. EXAMINATION OF A COMPUTATIONAL SCHEME. R. William Nelson and A. E. Reisenauer (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 15, 1961. Contract AT(45-1)-1350. 16p.

A scheme for overcoming the computational method of in-place permeability measurement of heterogeneous soils is examined. In the method, an initial estimate is successively improved until the potential computed from the permeability estimate agrees with the measured potential. Results of the work suggest avenues of further improvement. It is noted that the best available computational method at present for in-place measurement of permeability in heterogeneous media is the linear approximate scheme. (J.R.D.)

6791 (IS-424) THE MASS SPECTRA OF SOME VOLATILE HYDRIDES. F. E. Saalfeld and H. J. Svec (Ames Lab., Ames, Iowa). [Feb. 15, 1962]. Contract [W-7405-eng-82]. 18p.

The hydrides of group IVB and VB elements, except CH_4 and NH_3, have been prepared and, except for PbH_4 and BiH_3, their mass spectra studied. Fragmentation patterns and appearance potentials of the positive ions from these hydrides are reported. The ions have been tested for excess kinetic energy and this energy was found to be negligible. The average M-H bond energies and the ΔH_f^0 obtained from appearance potential data agree well with values obtained by other methods. Evidence is cited for the existence of distibine. (auth)

6792 (ISS 62/14) THE PHYSICS LABORATORIES OF THE ISTITUTO SUPERIORE DI SANITA UP TO 31ST MARCH 1962. (Italy. Istituto Superiore di Sanita, Rome). Apr. 1962. 86p.

Research and development progress is reported on high-energy physics, nuclear physics, nolecular physics, x-ray physics, electron microscopy, solid-state physics, and theoretical physics and computers. The technical services performed are also described. (M.C.G.)

6793 (JINR-P-1090) O PRICHINNOSTI V SOVREMENNOI TEORII POLYA. (On the Causality in the Present Field Theory). D. I. Blokhintsev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 10p.

An analysis was made of certain preliminary theoretical schemes that modify considerably small space-time magnitudes but conserve the macroscopic causality. (R.V.J.)

6794 (K-1498) SCATTERING OF HELIUM AND ARGON FROM THE CLEAVAGE PLANT OF LITHIUM FLUORIDE. J. C. Crews (Oak Ridge Gaseous Diffusion Plant, Tenn.). Mar. 23, 1962. Contract W-7405-eng-26. 28p.

The scattering of He and Ar from the cleavage plane of LiF was studied using molecular beam techniques and under vacuum conditions which were somewhat better than are typical for systems of this type. The He measurements confirm the diffraction effects reported by O. Stern and co-workers and reveal, in addition, a broad scattered beam approximately symmetrical about the specular position which apparently has not been previously recognized. Measurements with Ar beams gave scattering patterns which were quite different from those obtained for He. The scattered beams were very broad and had an intensity maximum between the specular position and the crystal normal. Analysis of the data showed that this deviation of the maximum from the specular position cannot be obtained by superposition of specular and cosine-law scattering components. Furthermore, the experimental data on the scattering of Ar seem to be inconsistent with a diffraction mechanism. (auth)

6795 (NP-12317) FEASIBILITY STUDY TOWARD DEVELOPMENT OF RADIATION RESISTANT SOLAR CELL. Interim Engineering Report, July 1–October 31, 1962. S. Kaye (Electro-Optical Systems, Inc., Pasadena, Calif.). Nov. 30, 1962. Contract NAS7-92. 44p. (EOS-2080-IR-2)

The feasibility of producing radiation-resistant silicon solar cells by the use of a graded base structure is being studied. Methods of fabrication of both n on p and p on n graded base cells are discussed and the results of efficiency measurements at sea level and on Table Mountain are presented. The results of bombarding the cells with 1-Mev electrons are shown and compared with the results obtained by bombarding n on p cells having a uniform base region of 25 ohm cm resistivity. The results of experiments designed to measure the presence of an electric field in the base region of the graded base cells by carrier transient time measurements are given. The results indicated that the graded base structure affects the transport properties of minority carriers injected into the base region of the cells. The electron irradiation experiments also indicated that the performance of the cells when subjected to 1-Mev electron bombardment is at least as good and may be superior to that reported on other silicon cells. (M.C.G.)

6796 (NP-12332) ANALYSIS OF MAGNETOGASDYNAMIC GENERATORS HAVING SEGMENTED ELECTRODES AND ANISOTROPIC CONDUCTIVITY. J. Conrad Crown (United Aircraft Corp. Research Labs., East Hartford, Conn.). Feb. 1961. 57p. (R-1852-2)

The basic equations describing the two-dimensional steady inviscid flow of a magnetogasdynamic fluid with anisotropic electrical conductivity were transformed into a more convenient form by the introduction of a current flux function. A method is presented for determining the electrodynamic field variables when the gasdynamic variables (velocity, temperature, pressure, etc.) are

constant. The method is sufficiently general that it may be applied to cases with arbitrary configurations and variable magnetic induction. The method was applied to the calculation of the field variables of a segmented-wall magnetogasdynamic generator with uniform applied magnetic induction. Results of typical calculations are presented. It was found that for increasing values of conductivity anisotropy, the current density concentration near the insulator-conductor junction increased. This current density concentration may seriously impair the performance of magnetogasdynamic generators. If the conductivity is excessively anisotropic, there may be a current leakage between adjacent electrodes. The field in the center of the channel was found to be more or less uniform and the existence of a sort of electrical "boundary layer" demonstrated. As a consequence of this, for increasing wall separation, the uniform center field characteristics approach those obtained from one-dimensional, anisotropic conductivity calculations. It was concluded that by appropriate choice of the parameters involved, the use of segmented walls in magnetogasdynamic generators may significantly reduce the losses which would otherwise be incurred due to anisotropic conductivity. (auth)

6797 (PIBAL-753) RADIATION BY A UNIFORMLY ROTATING POINT CHARGE. Manlio Abele (Brooklyn. Polytechnic Inst.). June 1962. 32p.

The spectral distribution of the radiation emitted by a uniformly rotating point charge in a dielectric medium was evaluated and compared to the Cherenkov radiation of a uniformly moving charge. Two particular cases of dispersive medium were analyzed. First the orbit of the charge was assumed to be enclosed in a perfectly conducting cylinder which acts as a mirror for the radiation; in the second case the charge rotates around a dielectric rod, and an analysis was conducted of the excitation of waves which propagate along the rod. (auth)

6798 (RM-2947-AEC) ON THE ENERGY DISTRIBUTION OF TERMS AND LINE ARRAYS IN ATOMIC SPECTRA. S. A. Moszkowski (RAND Corp., Santa Monica, Calif.). Jan. 1962. Contract AT(11-1)-135. 53p.

The Coulomb interaction leads to a splitting of the different terms belonging to the same many-electron configuration. The resulting energy distributions of terms and of line arrays for transitions between different configurations were studied. Expressions were derived for the first two moments of the distributions, namely, the average energy shift and the mean square deviation, as a function of the number of particles. The detailed shapes of the distributions were investigated both for $(d)^p$ configurations and for a simplified two-dimensional model. (auth)

6799 (TID-14708) THE DISTORTION OF ATOMS IN POLYATOMIC SYSTEMS. II. MODIFIED HARTREE-FOCK EQUATIONS FOR SEVERELY DISTORTED ATOMS. T. L. Gilbert (Argonne National Lab., Ill.). Nov. 1961. Contract [W-31-109-eng-38]. 41p. (UAC-5817)

The Hartree-Fock equations for systems with unlocalized valence electrons were transformed into two sets of coupled equations: the localized core equations, which are similar to the localized orbital equations derived for systems with slightly distorted atoms, and the pseudovalence equations, which have the form $[-(\hbar^2/2m)\nabla^2 + U']\varphi_{n\underline{k}} = \epsilon_{n\underline{k}}\varphi_{n\underline{k}}$ where U' is a Hermitian operator which is uniquely determined by the density operator and will, for many systems, be small enough to be treated as a perturbation. The eigenfunctions and eigenvalues of the standard form of the Hartree-Fock equations may be obtained from self-consistent solutions of the localized core and pseudovalence equations by a nonsingular linear transformation. In first approximation the localized core equations reduce to the Hartree-Fock equations for the core orbitals of free atoms and the pseudovalence equations reduce to a form which is similar to, but not identical with, the pseudopotential form of the OPW equations. In particular, the OPW pseudopotential depends on the eigenvalue while U' does not. The Hartree-Fock equations for systems with localized valence electrons (e.g., valence bond or molecular crystals) were transformed into equations for valence orbitals localized on pairs or groups of atoms which can be solved self-consistently together with the equations for the localized core orbitals. (auth)

6800 (TID-15495) PHONON-DEFECT RESONANCE INTERACTION. R. O. Pohl (Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics). [Apr. 19, 1962]. Contract [AT(30-1)-2391]. 9p.

Results of an investigation on resonance interaction between phonons and lattice defects are presented. It was found that the crystal system $KCl:KNO_2$ exhibits a phonon defect interaction which can be described by a simple resonance phenomena. The experiments also provided further insight into the nature of elastic waves in solids. Resonance interactions were shown which are analogous to those observed for optical quanta. (J.R.D.)

6801 (TID-17303) QUARTERLY PROGRESS REPORT NO. 67 [ON ELECTRONICS]. H. J. Zimmermann, G. G. Harvey, and W. B. Davenport, Jr. (Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics). Oct. 15, 1962. Contract AT(30-1)-1842. 296p.

Information and data are presented on the photoelectric properties of Ni, elastic constants of NH_4Cl, microwave spectroscopy, nuclear magnetic resonance and hyperfine structure, propagation of transverse waves, mechanics of molecular beams, plasma dynamics, statistical communication theory, code construction for two-way communications channels, mechanical translation techniques, linguistics, communications biophysics, neurophysiology, neurology, sensory mechanisms and aids, circuit theory and design, and computer applications. (J.R.D.)

6802 (TID-17348) THERMODYNAMIC MEASUREMENTS USING OPTICAL ABSORPTION IN METAL VAPORS (thesis). Philip A. Rice, David A. Ragone, and James A. Craig (Michigan. Univ., Ann Arbor. Coll. of Engineering). Aug. 1962. Contract AT(11-1)-543. 138p.

The amount and the reliability of the thermodynamic information which can be obtained by measuring the absorption of light in spectral lines and bands by metal vapors were investigated. The technique involves measuring the amount of light absorbed in particular small wavelength regions corresponding to the electronic transitions of gaseous atoms and molecules. The relationships existing between the amount of light absorbed by the equilibrium vapor and the vapor pressure were ascertained as a function of temperature. These were then used to deduce relationships from which activities of an element in solution and its heat of solution were calculated. Optical absorption measurements were made for pure Pb, pure Bi, a test Pb–Bi alloy, and a U–Bi alloy. From these measurements, the activities of Pb and Bi in the Pb–Bi alloy, the activity of Bi in U–Bi, and the heats of vaporization of Pb and atomic and diatomic Bi were calculated. The values of the heats of vaporization at 298°K obtained are tabulated. (auth)

6803 (UCRL-6389) ION ADSORPTION ON METALS FOR LOW FRACTIONAL SURFACE COVERAGE. Raymond Fox and William Gust (California. Univ., Livermore.

Lawrence Radiation Lab.). Aug. 6, 1961. Contract W-7405-eng-48. 21p.

A relation was derived which expresses the work function depression V_c, caused by low fractional surface coverage ion adsorption on metals, in terms of the emitted neutral atom flux density, ν_a, the temperature-independent component of the work function of the bare surface, ϕ_0, the surface temperature, T, and the ionization potential and the ionic radius of the emitted atoms, I and r_i, respectively. The relation is $\ln(\nu_a r_i / T^2\eta_c) + \eta_A = R_0\eta_c + \ln G$, where R_0 and G are constants; η_c is equal to eV_c/kT; η_a is equal to $(e/kT)[\phi_0 - I + (e/4r_i)]$; and e and k have their usual designations. The values for R_0 and ln G are found to be 0.38 and 25.25, respectively. Experimental results obtained for Cs adsorption on Ta, W, and Re, and the previous experimental results of Taylor and Langmuir were compared with the theory and good agreement has been found. A relation was also derived which determines the ambient plasma potential in front of a surface in terms of its work function, surface temperature, and the ratio of the incident neutral atom current density to the emitted electron current density. If the ratio of the incident atom current density to the emitted electron current density is large, then ambient potentials of several volts are found for surfaces which have work functions comparable to or greater than the ionization potential of the incident atoms. (auth)

6804 (UCRL-6630-T) QUANTIZED MAGNETIC FLUX AND THE NATURE OF ELECTRICAL CURRENTS. J. W. Zink (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 21, 1961. Contract W-7405-eng-48. 8p.

It is shown that the pairing of electrons is not necessary to explain the quantization of magnetic flux. The nature of electrical currents is discussed. A theory is presented for the quantized magnetic flux associated with both normal and closed currents. (M.C.G.)

6805 (UCRL-6702) THE IONIZATION OF HELIUM AND ARGON BY ELECTRON IMPACT. Gilbert O. Brink (California. Univ., Livermore. Lawrence Radiation Lab.). Dec. 11, 1962. Contract W-7405-eng-48. 10p.

The total ionization cross sections of He and Ar have been measured over the energy range from 20 to 500 ev by a molecular beam technique. The results agree well with those of previous workers. (auth)

6806 (UCRL-7052) THE STATUS OF TRANSPORT PROPERTIES OF AIR. V. E. Schrock (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 25, 1962. Contract W-7405-eng-48. 28p.

The status of experimental data for air is explored, and the measurement problem, techniques, and predictions available from the general transport theory of Boltzmann are reviewed. Because the constant-pressure specific heat is known to a high degree of accuracy, the Prandtl number $c_p\eta/k$ is customarily calculated from it and the best available viscosity and thermal conductivity. For this reason, emphasis is given here to viscosity and thermal conductivity. (R.J.S.)

6807 (UCRL-9819) RECENT SUPERCONDUCTIVITY TESTS AND STUDIES. Paul R. Aron, H. Paul Hernandez, and Harley C. Hitchcock (California. Univ.; Berkeley. Lawrence Radiation Lab.). Aug. 15, 1961. Contract W-7405-eng-48. 26p.

The results of recent tests with Nb_3Sn and Nb-Zr alloy wires show that the superconducting critical-current properties of both materials are very promising in tests made with short samples. At present, Nb-Zr alloys have higher critical current densities than Nb_3Sn in magnetic fields below 60 kgauss. Nb_3Sn will go beyond 60 kgauss and has remained superconducting as high as 180 kgauss. Pulsed d-c tests on short wires of Nb-25 at.% Zr at frequencies from 1 to 1,000 pps give the same critical currents as the d-c tests. Tests with small coils have not progressed beyond the 15-kgauss range. A coil wound with Nb-25 at.% Zr alloy wire reached 7.8 kgauss—a factor of $2^1/_2$ below the design point—but remained superconducting at the 7.8 kgauss plateau in external fields up to 70 kgauss. A coil of Nb_3Sn wire performed as predicted at 90 amp and 8 kgauss. The effort now is to find out why short lengths of superconducting wire have better critical-current properties than coiled long lengths. (auth)

6808 (UCRL-9824) FABRICATING LIQUID-HYDROGEN TARGETS FROM MYLAR. David L. Mehr (California. Univ , Berkeley. Lawrence Radiation Lab.). Aug. 17, 1961. Contract W-7405-eng-48.

A method of constructing Mylar containers for cryogenic-liquid targets is described. Such containers satisfy the need for maximum beam transparency and suitable low-temperature strength that are required in the use of liquid-H_2 targets for physics research. (J.R.D.)

6809 (AEC-tr-5567) REPORT ON THE RESULTS OBTAINED IN CONNECTION WITH OUR PREPARATIONS FOR THE STUDY OF NEUTRON DIFFRACTION. Pál Szabó. Translated for Argonne National Lab., Ill. from Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 8: No. 4, 189-93(1960). 5p.

A brief survey of work in connection with neutron diffraction measurements is given. Results were obtained in the calculation of intensity transmitted by collimators, consequently in the dimensioning of collimators; in the production and orientation of monochromator crystals; in the development of a new counter tube type; and in the theory of the scattering of fine crystalline carbons. (auth)

6810 (CEA-tr-X-477) EXPÉRIENCES SUR LES LENTILLES ÉLECTROSTATIQUES. (Experiments with Electrostatic Lenses). Tadatosi Hibi and Katsuya Yamaguchi. Translated into French from Oyo Butsuri, 27: 492-6(1958). 13p.

The most commonly used circular-slot lenses are examined. Then a study is made of electrostatic lenses with slots of various shape for which the distribution of the electric field on the optical axis is not theoretically known. Combinations of these different lenses are also taken into consideration. In all cases the sample images and the focal shape were experimentally determined. The results showed that in the three-electrode lens the image and focus were strongly affected by the central electrode, whereas the external electrodes re-enforce the effect of the central electrode. A four-electrode lens was conceived which gives a correct image and a sharper and more pointed focus than lenses with circular slots. (J.S.R.)

6811 (FTD-TT-62-981) DEFORMATION OF A TRAVELLING MAGNETIC FIELD UNDER THE SURFACE OF A CONDUCTIVE MEDIUM. Jaroslav Schilder. Translated from Elektrotech. Casopis, No. 5, 287-309(1961). 30p.

Characteristics of magnetic field breakouts (frontal and lateral) are revealed. The deformations (breakouts) of nonhomogeneous magnetic fields moving under the surface of a conductive medium are explained using the skin effect theory. The frontal breakout takes place in rotors of asynchronous motors and is formed by rollers. The lateral breakout occurs during magnetic circuits from lamellar components, e.g., in stator yokes of alternating electric installations. (N.W.R.)

6812 (FTD-TT-62-1181) THE THEORY OF A MAGNETOGASDYNAMIC GENERATOR. M. I. Kiselev. Translated from Vestn. Mosk. Univ., Ser. III, No. 1, 63-8(1962). 10p.

The effect of profiling the channel of a magnetogasdynamic generator on the efficiency of the conversion of thermal energy into electrical energy and on the dimensions of the generator was investigated. The order of the efficiency in the case of small magnetic Reynolds numbers in the supersonic region is indicated, and a method of estimating the efficiency for $Re \geq 1$ is given. Viscosity and heat conduction were neglected. (auth)

6813 (NP-tr-930) SPUTTERING OF SOLIDS (STUDY OF THE LITERATURE). Rainer Behrisch (Max-Planck-Institut fur Physik und Astrophysik, Munich). Translated by F. C. Allen and J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Vac. Laboratory Report No. 20. Mar. 1961. 100p.

A review of publications on the sputtering of solids that appeared up to March 1961 is presented. Topics covered include: experiments on metal sputtering, results from sputtering measurements, and theoretical considerations. One-hundred-and-fifteen references are included. (M.C.G.)

6814 (UCRL-Trans-887(L)) MODIFICATION CHANGES OF ZIRCON AND HAFNIUM. C. Zwikker. Translated for Univ. of California Lawrence Radiation Lab., Livermore from Physica, 6: 361-5(1926). 11p. (Includes original, 5p.)

Results of investigations concerning the resistivity of Zr and Hf wire are discussed. Beginning at room temperature, the resistivity of Zr slowly increases to a maximum at 1100°K, it then decreases to a minimum at 1400°K, increasing again with temperature rise. The resistivity of Hf is analogous; it has a maximum at 1600°K and a minimum at 1900°K. It is noted that in the cooler ends of Zr or Hf filaments, there is always an area of abnormally high resistivity. The heat in the filament section has the effect of shortening the cooled filament end for Zr and Hf as compared with metals such as W or Pt. (J.R.D.)

6815 SOME PROBLEMS RELATING TO THE ELECTRIFICATION OF DUST FROM β-IRRADIATED KCl MONOCRYSTALS. Anna Szaynok (Inst. of Tech., Warsaw). Acta Phys. Polon., 22: 225-40(Sept. 1962). (In English)

Investigation on β-ray irradiation of KCl monocrystals yielded some information as to the influence of lattice defect concentration in the crystal on the electrification of the dust produced therefrom. The electric charge of the dust from a KCl monocrystal arises as a result of cleavage of the crystal lattice. The presence of lattice defects increases the probability of electrification. The mean surface charge density of the dust particles depends on the concentration of lattice defects in the crystal. Three main factors cause electrification of the dust of KCl monocrystals irradiated with β rays: the F-center concentration, absorption of electrons in the crystal, and secondary emission. (auth)

6816 BEHAVIOR OF A CHARGED PARTICLE IN A SINUSOIDAL ELECTROMAGNETIC FIELD. Bernardo Wolf (Facultad de Ciencias, U. N. A. M.). Acta Politec. Mex., 2: 593-604(May-June 1961). (In Spanish)

Consideration is given for the case of a charged particle of matter, located in a region of space where an electric and a magnetic field exist perpendicular to each other: the intensity of these fields changes sinusoidally with time. The problem is attacked in a classical manner: it is supposed that the movement of the charge is sufficiently slow to avoid a radiation of energy or other collateral phenomena. The conditions of the problem are conducive to a system of differential equations, the solution of which describes the behavior of the particle. Explicit formulas are obtained for acceleration, speed, and displacement of the particle as functions of its specifications, and of the intensity and frequency of oscillation of the fields. In order to be able to appreciate in a general way the dependence of the trajectory from the frequency of oscillation, the case of determined frequencies is specifically considered, which produce characteristic cycloidal trajectories. This can be noticed as well by the vector speed as by the interpretation of the trajectory. The particle moves in the direction in which, in a physical case, the electromagnetic waves move, and this movement is strongly influenced by the frequency of oscillation of the fields. These deductions have not been applied to a concrete physical case, as for instance the behavior of ions or charged particles under the constant action of an electromagnetic wave of low energy. The "macroscopic speed" of the particle, that means the speed calculated as the quotient of the coordinate run through in a period divided by the period, is the object of an analysis. (auth)

6817 BASIC EQUATIONS OF THE M.H.D. GENERATOR. Ch. Szendy (Power Stations Engineering Inst., Budapest). Acta Tech. Acad. Sci. Hung., 40: 431-9(1962). (In English)

A formula containing complex quantities of the electric and magnetic field strengths, the current density, and the gas velocity is introduced. If the resultant space charges and the ion slip to gas stream can be neglected, the electric field strength is found, and can be used for the determination of power output and losses. (auth)

6818 A STATISTICAL THEORY OF TRANSPORT PHENOMENA. Laurence S. Hall (Univ. of California, Livermore). Ann. Phys. (N. Y.), 20: 383-449(Dec. 1962).

A systematic procedure for the derivation of transport equations from the Liouville equation through the use of the BBGKY (Bogoliubov-Born-Green-Kirkwood-Yvon) hierarchy is put forward. The unique feature of the analysis is the use of statistical considerations to determine the method of truncating the hierarchy. A variational technique for the performance of Gibbs' ensemble average, which amounts essentially to an a priori assumption of an H-theorem, is used to determine the missing information when a lower member of the BBGKY hierarchy is substituted for the Liouville equation. The procedure is illustrated for the case of truncation at the lowest level in the hierarchy, and in a certain approximation the Fokker-Planck equation is recovered. However, in order to effect a complete evaluation of the coefficients of the Fokker-Planck term at this level, it is found that a physical principle that is implicit in the Fokker-Planck coefficients must be postulated. A discussion of this feature and a proposed experimental check on the analysis are given. (auth)

6819 MOLAR VOLUME AND EXPANSION COEFFICIENT OF LIQUID He^3. Eugene C. Kerr and R. Dean Taylor (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. (N. Y.), 20: 450-63(Dec. 1962). (LADC-5369)

Direct measurements of the molar volume of liquid He^3 under its own vapor pressure are made over the temperature range 0.16 to 1.8°K. Expansion coefficient values derived from computer analysis of over one hundred direct observations range from zero at 0°K to a minimum of $-0.0104°K^{-1}$ at 0.194°K, again to zero at 0.502°K, and at higher temperatures increase monotonically. These results are in semiquantitative agreement with the theory. Comparisons are made with the results of several indirect determinations of the expansion coefficients. (auth)

6820 DEDUCTION OF ION RANGES IN SOLIDS FROM COLLECTION EXPERIMENTS. Mark T. Robinson (Oak Ridge National Lab., Tenn.). Appl. Phys. Letters, 1: 49-51(Oct. 1962).

A way of deriving the mean penetration of an ion or atom from measurements of the sputtering yield of a solid target and of amounts of beam material collected in the target during irradiation is discussed. Theory is presented as are data from previous experiments, showing a pronounced reliance of steady-state quantity of trapped material on the direction of irradiation during the collection of 45-kev Kr^+ in monocrystalline Cu. (D.C.W.)

6821 TIME LAG OF THE GAS BREAKDOWN IN CROSSED ELECTRIC AND MAGNETIC FIELDS. F. Deutsch and P. Avivi (Hebrew Univ., Jerusalem). Appl. Phys. Letters, 1: 66-7(Nov. 1962).

The formative time lag in a law pressure discharge that is triggered by a pulsed magnetic field perpendicular to the d-c electric field is examined. Equipment diagrams and plots of the results are included. A spark gap triggered by a magnetic pulse may result from extension of this work. (D.C.W.)

6822 STANDARDIZATION OF POINT AND DISTRIBUTED γ-RAY SOURCES. Richard C. McCall and Kurt Lidén (Univ. of Lund, Sweden). Arkiv Fysik, 22: 497-502(1962).

The feasibility of the use of NaI scintillation counters, in conjunction with theoretical efficiencies and photofractions, in order to calibrate and standardize point and distributed gamma sources, is investigated. This method is found to be simple, versatile, and applicable to situations in which the highest accuracy is not required. (T.F.H.)

6823 INTENSITY DETERMINATION OF PHOTOGRAPHICALLY RECORDED CONVERSION LINES. [PART] II. Hilding Slaetis (Nobel Inst. of Physics, Stockholm). Arkiv Fysik, 22: 517-33(1962).

The determination of the relative intensity of conversion lines recorded photographically in a semicircular beta spectrometer is treated. Two methods are briefly described, both of which are based on the formula for the photographic density as a function of the electron density. In the first method the influence of the photographic sensitivity versus electron momentum is considered. In the second method, the calibration is specific for a specific spectrometer and film type. By this means sources of error such as the neglect of the influence of the varying differential grain density along the electron tracks are eliminated. Both methods can be used with or without the so-called "rectangle" approximation, consisting in replacing the integrated area under a conversion line by a rectangle, the height of which is equal to the height of the electron intensity distribution line and the width of which is equal to the true half-width of the line. The second method is applied to a study of the K/L_I-conversion ratio for the 239-kev transition in the decay of Pb^{212}. The ratio is found to be 5.8, in agreement with measurements using electronic detection of the beta rays. (auth)

6824 EXPERIMENTAL gf-VALUES FOR SEVENTY ELEMENTS. Charles H. Corliss (National Bureau of Standards, Washington, D. C.). Astrophys. J., 136: 916-34(Nov. 1962).

Relative intensities of 39,000 spectral lines with wavelengths between 2000 and 9000 A have been determined on a uniform energy scale for seventy elements. The light-source was an arc between copper electrodes to which a single element was added in the ratio of 1 atom of element to 1000 atoms of copper. The spectrograms were calibrated with standard lamps. The temperature of the arc was determined, by comparison of the observed intensities with published relative gf-values, to be 5100° ± 110°K. The degree of ionization of eleven elements in the arc was determined by comparison of intensities in spectra of neutral and ionized atoms with known absolute gf-values. With the aid of Saha's ionization equation, the electron density in the arc was found to be 2.4×10^{14} cm^{-3}. The ionization of seventy elements separately added to the arc was then calculated with Saha's equation. A correction was made for diffusion of atoms from the arc stream. With this information, relative values of gf on a uniform scale can be computed for the 25000 lines which have been classified. By calibration with known absolute gf-values, the scale is put on an absolute basis. The accuracy of the results is discussed. A curve of growth for Y_{II} in the sun is constructed with the gf-values to test their utility. (auth)

6825 THE BOUND-FREE ABSORPTION COEFFICIENT OF THE HYDROGEN NEGATIVE ION. S. Geltman (National Bureau of Standards, Washington, D. C.). Astrophys. J., 136: 935-45(Nov. 1962).

The bound-free absorption coefficient of H^- is evaluated by using a set of successively improved bound- and free-state wave functions. Better agreement with experiment and greater theoretical consistency are shown to result. The best theoretical result is tabulated for use in astrophysical applications. (auth)

6826 NEW PRESENTATION OF THE THERMODYNAMICS OF THE ISOLATED PARTICLE. Louis de Broglie. Compt. Rend., 255: 807-10(July 30, 1962). (In French)

A new presentation of the thermodynamics of the isolated particle developed previously (Compt. Rend., 253: 1078 (1961)) is given under a slightly different form and with new precision. (tr-auth)

6827 THE ZEMPLEN THEOREM IN FLUID MAGNETODYNAMICS. Roger Thibault. Compt. Rend., 255: 834-6(July 30, 1962). (In French)

A new demonstration of the Zemplen theorem is proposed using the Weyl hypothesis and avoiding the difficulties caused by intermediary collisions. The case of semi-weak collisions was made the object of special study. (tr-auth)

6828 SELF-DIAMAGNETIC SUSCEPTIBILITY OF ELEMENTS. ELEMENTS CHARACTERIZED BY THE COMPENSATING SPIN OF THE s ELECTRONS OF THE EXTERNAL SHELLS (1 TO 6). Rose Aynard. Compt. Rend., 255: 860-2(July 30, 1962). (In French)

The self-diamagnetic susceptibility was calculated for a number of elements and the values obtained were compared with recent experimental values. The derivation of the equation for the self-diamagnetic susceptibility was derived by assuming that the susceptibility varies as a function of the successive filling of the external shells, increasing because of their compensating spins. (J.S.R.)

6829 THE EQUATIONS OF RELATIVISTIC MAGNETOHYDRODYNAMICS. Mircea Zăgănescu and Gheorghe Drecin (Facultatea de Matematică-Fizică, Timişoara, Romania). Compt. Rend., 255: 1436-7(Sept. 17, 1962). (In French)

The complete equations of relativistic magnetohydrodynamics in the Fock approximation are derived. (J.S.R.)

6830 POSSIBILITY OF A NON-MAXWELLIAN DISTRIBUTION OF ELECTRON VELOCITIES. Suzanne Souffrin (Institut d'Astrophysique, Paris). Compt. Rend., 255: 1496-8(Sept. 24, 1962). (In French)

A study is made to determine under what ionization conditions the inelastic collisions can determine a non-Maxwellian distribution of electron velocities at high ener-

gies. It was found that for a mean energy of the order of 1 ev, the degree of ionization must be less than 0.1 if the function is to have a clear variation from Maxwellian distribution. (tr-auth)

6831 THE INFLUENCE OF POSITIVE IONS ON EXO-ELECTRON EMISSION. R. Seidl and V. Střelka. Czech. J. Phys., 12: 707-13(1962). (In German)

The effects of collisions of positive ions with electron-emitting surfaces on the exoelectron emission characteristics of these surfaces are measured using a G-M counter. Both photoelectric and thermionic emission are considered. The probable mechanisms influencing the emission are discussed. (T.F.H.)

6832 A NOTE OF THE SEMI-EMPIRICAL THEORY OF SECONDARY ELECTRON EMISSION. V. Malát (Charles Univ., Prague). Czech. J. Phys., 12: 720-1(1962). (In English)

It is noted that the range of primary electrons in a material can be expressed as $B\rho^{-1}E_0^{1.35}$, where $B = 1.14 \times 10^{-6}$ g cm^{-2} $ev^{-1.35}$, ρ is the density of the material, and E_0 is the energy of the primary electron. The value given for B is postulated to be valid for any material. Using this relation for the range, the coefficient of secondary emission is found as a function of only two arbitrary parameters. (T.F.H.)

6833 DEPENDENCE OF PHOTOELECTRON ANGULAR DISTRIBUTION ON THE γ EMISSION ENERGY. A. A. Remskii-Korsakov and V. V. Smirnov. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1169-71(Sept. 1962). (In Russian)

Angular distribution of photoelectrons as a function of γ energy was evaluated using the Monte-Carlo method. The results show a quantitative picture of virtual angular distribution and its variations with target Z and incident γ energy. The ordinary expression for photoelectron emission dependence on the angle of the γ beam is described by αZ (where $\alpha = 1/137$). Terms in the $\sim\alpha Z$ and $\sim(\alpha Z)^2$ series do not contribute at $\theta = 0$. It postulated that a proportional $(\alpha Z)^3$ term is responsible for the anomalous I_0 intensity not considered in the Zauter formula. The conclusion holds with the fact that I_0/I_{max} (anomalous electron emission forward at $\theta = 0$ and θ_{max}) increases proportionally with Z^3 at constant $h\nu$ incidence quanta. (R.V.J.)

6834 MICROSCOPIC BASIS OF MACROSCOPIC MAGNETOSTATIC ENERGY. Allan N. Kaufman (Univ. of California, Livermore) and Toshio Soda. J. Chem. Phys., 37: 1988-90(Nov. 1, 1962). (UCRL-6499-T(Rev.II))

A microscopic description of the electromagnetic interactions among a set of charged particles, valid to terms of order c^{-2}, was used to derive a number of well-known expressions for macroscopic electrostatic and magnetostatic energy and work. Particular attention was paid to the assumptions required for the validity of the expressions, and to the relations between the various nonequivalent expressions bearing the same name (such as magnetic work). (auth)

6835 SCATTERING OF HELIUM AND ARGON FROM THE CLEAVAGE PLANE OF LITHIUM FLUORIDE. J. C. Crews (Oak Ridge Gaseous Diffusion Plant, Tenn.). J. Chem. Phys., 37: 2004-8(Nov. 1, 1962). (K-1498)

The scattering of helium and argon from the cleavage plane of lithium fluoride was studied using molecular-beam techniques and under vacuum conditions. The helium measurements revealed a broad scattered beam approximately symmetrical about the specular position which apparently has not been previously recognized. Measurements with argon beams gave scattering patterns which were quite different from those obtained for helium. The scattered beams were very broad and had an intensity maximum between the specular position and the crystal normal. Analysis of the data showed that the deviation of the maximum from the specular position cannot be obtained by superposition of specular and cosine-law scattering components. Furthermore, the experimental data on the scattering of argon seem to be inconsistent with a diffraction mechanism. (auth)

6836 VELOCITY DEPENDENCE OF THE DIFFERENTIAL CROSS SECTIONS FOR THE SCATTERING OF ATOMIC BEAMS OF K AND Cs BY Hg. Fred A. Morse and Richard B. Bernstein (Univ. of Michigan, Ann Arbor). J. Chem. Phys., 37: 2019-27(Nov. 1, 1962).

Measurements of the velocity dependence of the angular intensity distribution of potassium and cesium beams scattered by a crossed beam of mercury are presented. The alkali beam was velocity selected, with a triangular velocity distribution (half-intensity with 4.7% of peak velocity); the velocity was varied over the range 185–1000 m/sec. The Hg beam had a thermal distribution; the average Hg speed was ~235 meters per second. The scattering data were converted to the center-of-mass system. The angular distributions show the expected strong forward scattering and evidence the phenomenon of rainbow scattering. The energy dependence of the rainbow angle was used to evaluate the interatomic potential well depth, interpreted as the dissociation energy D_e of the $^2\Sigma^+$ molecular ground state. Values (in erg $\times 10^{14}$) thus obtained (±5%) were 7.4 for KHg and 7.7 for CsHg. Absolute values of differential cross sections could not be obtained; only relative cross sections $D(\theta)$ are reported. The observed low-angle behavior $D(\theta) \propto \theta^{-1/3}$ serves as direct experimental confirmation of the r^{-6} dependence of the long-range attractive potential for K–Hg and Cs–Hg systems. (auth)

6837 A COMPARISON OF THE INTENSITIES OF EMISSION OF Eu^{3+} AND Tb^{3+} IN TUNGSTATES AND MOLYBDATES. L. G. Van Uitert (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Electrochem. Soc., 110: 46-51 (Jan. 1963).

The intensity of emission of Eu^{3+} is shown to vary with its electrostatic binding energy in the tungstates which have the scheelite structure. Increasing the polarization of the oxygens toward Eu^{3+} or Tb^{3+} appears to decrease the total binding energies of these ions in the tungstates and molybdates. Brightness can either increase or decrease with binding energy depending on the effectiveness with which the host structure can capture excitation energy and communicate it to the rare earth ions involved. (auth)

6838 VLF EMISSIONS AND GEOMAGNETIC DISTURBANCES AT THE AURORAL ZONE. PART II. CHORUS INCREASES AND GEOMAGNETIC PULSATIONS AT THE AURORAL ZONE. Tadanori Ondoh (Kyoto Univ.). J. Geomagnet. Geoelec., 14: 86-98(1962).

A close relation has been found between increases of chorus indices continuing for a few hours and geomagnetic pulsations at the auroral zone, using the chorus indices and rapid-run magnetograms at College, Alaska, during July 1959 to December 1960. During this period 79 increases of chorus indices occurred in relatively quiet geomagnetic-conditions after geomagnetic bay-like disturbances. Of 79 chorus increases, 52 were associated with geomagnetic pulsations with periods between 1 and 6 minutes and 11 were associated with pulsations having periods of about 30 seconds. The chorus increases may be generated by penetration of high speed charged particles into the exosphere, which may also be related to the geomagnetic pul-

sations. A possible mechanism of the generation of geomagnetic pulsation has been discussed. (auth)

6839 BEHAVIOR OF GEOMAGNETICALLY TRAPPED ELECTRONS INJECTED BY HIGH-ALTITUDE NUCLEAR DETONATIONS. J. B. Cladis and M. Walt (Lockheed Missiles and Space Co., Palo Alto, Calif.). J. Geophys. Res., 67: 5035-54(Dec. 1962).

This report describes recent investigations of the data obtained by the Jason sounding rockets during the Argus nuclear weapon tests. These instrumented rockets contained radiation detectors and observed electrons that were injected into the geomagnetic field by the decaying fission fragments from the second Argus explosion. An earlier analysis of the data has been published. The further investigations reported here yielded (1) the orientations of the detectors with respect to a plane perpendicular to local magnetic lines of force, (2) the calibration of the detectors in a planar flux of electrons as functions of electron energy and orientation of the detectors with respect to the electron plane, and (3) a re-evaluation of the Jason data based on items (1) and (2) and on recent data on characteristics of the natural radiation. The conclusions verified the results of the initial analysis regarding the location, width, and stability of the electron 'shell' produced by the Argus 2 detonation, as well as the presence of a less intense electron flux in wide regions (wings) away from the shell. In contradiction to the earlier analysis, it was found here that the electron spectrum was much more in agreement with the fission β spectrum. Within the accuracy of the data, the observed spectrum was found to be independent of the spatial locations of the rockets or of the passage of time. During the first 89 hours after the detonation, the decay of the flux appears to follow a time dependence of $t^{-1.15\pm0.03}$. (auth)

6840 THE DEPOSITION OF BERYLLIUM 7 AND PHOSPHORUS 32 IN PRECIPITATION AT NORTH TEMPERATE LATITUDES. Alan Walton and Ralph E. Fried (Isotopes, Inc., Westwood, N. J.). J. Geophys. Res., 67: 5335-40(Dec. 1962).

The concentrations of Be^7 and P^{32} in fourteen precipitation samples from Westwood, N. J., have been measured for the purpose of studying the mechanisms involved in the deposition of natural and artificially produced radioactivity. After due allowances were made for rainfall amounts it was calculated that the deposition of these nuclides at temperate latitudes did not differ greatly from that found in the tropical regions, namely in India. Observed rates of deposition also agreed quite well with those calculated on the basis of the entire production of Be^7 and P^{32} within the troposphere. In some instances the observed ratios of Be^7/P^{32} did not exclude the possibility of incursion of recent stratospheric air into air masses from which the radioactivity was derived. (auth)

6841 MAGNETIC EFFECTS OF HIGH-ALTITUDE BOMB. A. M. van Wijk (Magnetic Observatory, Hermanus, C. P., Republic of South Africa). J. Geophys. Res., 67: 5352(Dec. 1962).

Noticeable effects on the magnetic traces at Hermanus (34°25.5'S, 19°13.5'E) produced by the high-altitude nuclear detonations of July 9, 1962 are shown. (W.D.M.)

6842 ELECTRON PAIRS IN THE BERYLLIUM ATOM. Thomas L. Allen (Univ. of California, Davis) and Harrison Shull. J. Phys. Chem., 66: 2281-3(Dec. 1962).

The electron-pair approximation in the beryllium atom is investigated using a properly antisymmetrized product function over geminals (electron-pair wave functions). A wave function of this relatively simple type is obtained having an overlap of 0.9998886 with one of the best published functions, a superposition of 37 configurations. As a consequence of the separation into electron pairs, some of the coefficients in the configuration interaction treatment are found to be interrelated. (auth)

6843 INFRARED EMISSION SPECTRUM OF CESIUM OBSERVED WITH THE AID OF A NEW MONOCHROMATOR. Jacques Séguier (Laboratoire des Recherches Physiques, Sorbonne, Paris). J. Phys. Radium, 23: 393-7(July 1962). (In French)

The infrared emission spectrum of cesium was observed between 1.6 and 3.7 μ using a classical spectrometer, and between 1.9 and 2.5 μ using a new grating-slit spectrometer. Twenty-four new lines of cesium were classified. (auth)

6844 STRONG CYLINDRICAL SHOCK WAVES IN MAGNETOGASDYNAMICS. J. D. Murray (Hertford Coll., Oxford). Mathematika, 8: 99-120(Dec. 1961).

A method is developed for finding the distribution of velocity, density, pressure, and magnetic field behind an expanding strong cylindrical shock wave in an infinitely conducting fluid in the presence of a magnetic field. In the flow of such a fluid there are two distinct methods for producing a strong shock: by fixing the density ratio across the shock, as in the non-magnetic case; and by imposing a large magnetic field, such that the Alfvén velocity is very much larger than the speed of sound. The distribution of the various physical quantities and the velocity of propagation of the shock are discussed for both cases, and numerical results are given. (auth)

6845 THE STABILITY OF A PLANE ALFVÉN WAVE OF FINITE AMPLITUDE. D. H. Michael (University Coll., London). Mathematika, 8: 133-41(Dec. 1961).

The stability of a plane current-vortex sheet in a non-diffusing incompressible fluid is studied for the case in which a magnetic field, not parallel to the sheet, is present. It is shown that two Alfvén waves are formed that move in opposite directions along the normal to the sheet. The stability of and conditions in these plane Alfvén wave fronts are studied. (T.F.H.)

6846 NOTE ON A BIHARMONIC GREEN'S FUNCTION. G. M. Adams and W. R. Dean (University Coll., London). Mathematika, 8: 159-69(Dec. 1961).

An expression is found for the biharmonic Green's function, $G(x,y;x_1,y_1)$, for an infinite area in the x-y plane bounded internally by a single curve. At all points of the boundary, G is found to have a zero of the second order. (T.F.H.)

6847 IONOSPHERIC EFFECTS OF NUCLEAR EXPLOSIONS. W. J. G. Beynon and E. S. O. Jones (Univ. College of Wales, Aberystwyth). Nature, 196: 253-4 (Oct. 20, 1962).

Dieminger and Kohl (Nature, 193: 963(1962)) described some ionospheric phenomena observed at Lindau, Germany, on October 30, 1961, following a large nuclear explosion at Novaya Zemlya in the arctic. Since the recordings were made at ½-hourly intervals, the precise time of the onset of the disturbance could not be pinpointed. For a large part of the day concerned, recordings were made at Aberystwyth, Wales, at ¼-hourly intervals and these provide additional information on the ionospheric effects at a distance of 3570 km from the source. Data from these measurements are given. (L.T.W.)

6848 SPREAD F DEVELOPMENT ASSOCIATED WITH A HIGH-ALTITUDE NUCLEAR EXPLOSION. L. H. Heisler and L. D. Wilson (Univ. of Sydney). Nature, 196: 258 (Oct. 20, 1962).

Ionospheric phenomena associated with the high-altitude thermonuclear explosion over Johnston Island on July 9, 1962, were monitored in Sydney, Australia, using a panoramic ionosonde that provided ionograms made by a 15-sec linear scan over a frequency range of 0.5 to 9.5 Mc/s at a rate of one every minute. A rapid development of spread F was observed which is ascribed to the explosion. (L.T.W.)

6849 PERMANENT INSULATING DUCT WALLS FOR MAGNETOHYDRODYNAMIC POWER GENERATION. J. Maycock (Central Electricity Research Labs., Leatherhead, Surrey, Eng.), D. T. Swift-Hook, J. K. Wright, and P. Ramsden. Nature, 196: 260-1(Oct. 20, 1962).

A new type of duct wall construction is described that appears to overcome the drawbacks of previous designs. It consists of a set of parallel metal tubes carrying cooling water (or other coolant) and which are insulated from each other by a thin layer of material such as sprayed alumina. The parts of the tubes facing the flame may be bare metal, and any gas penetrating to the insulating material between the tubes will be cooled before reaching it. The rear faces of the tubes remain cold and can be mounted in any convenient way to provide a gas-tight seal so that hot gas does not penetrate. It is concluded that the duct wall construction may provide permanent insulating duct walls for magnetohydrodynamic generators. (L.T.W.)

6850 CAPE TOWN ANOMALY AND AURORAL EMISSION. J. A. Gledhill and H. O. Van Rooyen (Rhodes Univ., Grahamstown, South Africa). Nature, 196: 973-5(Dec. 8, 1962).

A region of anomalously high radiation intensity, ascribed to the outer radiation belt, was discovered recently between Cape Town and Antarctica and is called the "south radiation anomaly." It is pointed out that the particle flux into the south radiation anomaly is probably large enough to produce observable auroral effects. (L.T.W.)

6851 THE K-SHELL PHOTOELECTRIC EFFECT IN THE FORWARD AND BACKWARD DIRECTIONS. Arne Reitan (Nordisk Institut for Teoretisk Atomfysik, Copenhagen). Phys. Norvegica, 1: 113-19(1961). (In English)

The first non-vanishing correction term is calculated, by the successive Born approximation method, for photoelectric emission cross sections in the directions parallel and antiparallel to the incident photon. (auth)

6852 ENERGY OF A VORTEX RING IN A TUBE AND CRITICAL VELOCITIES IN LIQUID HELIUM II. J. C. Fineman and C. E. Chase (Massachusetts Inst. of Tech., Lexington). Phys. Rev., 129: 1-7(Jan. 1, 1963).

Various authors have suggested that critical velocities v_c in liquid helium II may result from the formation of vortex rings according to Landau's criterion, $v_c = (E/p)_{min}$, where E is the energy of the ring and p its impulse. In considering the possible formation of rings inside the channel from this point of view, however, the effect of the walls on E and p has been neglected. By solving Laplace's equation in series, we have evaluated the energy of a circular classical vortex ring with an empty streamlined core confined coaxially in a long circular tube of radius R; numerical results are presented for various core radii a and ring radii r_0. E has a maximum at $r_0 \approx 0.9$ R, and approaches zero as $r_0 \to$ R. Boundaries do not affect the impulse, so Landau's criterion applied to such a classical vortex ring gives $v_c = 0$, contradicting experiment. We may conclude that for some reason vortex rings must not be formed inside the channel, unless some special mechanism prevents their formation (or their causing friction if formed) too near the walls. Numerical results are also presented for the exact solution in an unbounded fluid. (auth)

6853 ENERGY DISTRIBUTION OF ELECTRONS EJECTED FROM TUNGSTEN BY He^+. F. M. Propst (Univ. of Illinois, Urbana). Phys. Rev., 129: 7-11(Jan. 1, 1963).

The results of a calculation of the energy distribution of electrons ejected from tungsten by low-energy He^+ are presented. The calculation is based on a mechanistic model of the process in which the ejected electrons are divided into two groups: (1) the electrons excited in the primary process that can escape directly; and (2) the electrons that escape because of interactions between the primary electrons and those of the band structure of the solid. Secondary electron data are used to predict the portion due to this second mechanism. (auth)

6854 RESONANCE ABSORPTION OF GAMMAS BY IMPURITY NUCLEI IN CRYSTALS. William M. Visscher (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 129: 28-36(Jan. 1, 1963). (LADC-5315)

The aspects of the dynamics of a simple cubic crystal model with a dilute impurity which are relevant to the Mössbauer effect are considered. Harmonic nearest-neighbor forces are used, and the mass and force constant of the active nucleus differ from those of the host lattice. The calculations are carried out using a Green's function approach with the aid of an IBM 7090 computer. The recoilless fraction, temperature shift, frequencies and amplitudes of localized mode, and absorption spectra are calculated as functions of temperature, impurity mass, and coupling constant. One interesting feature of the results is that the recoilless fraction is independent of the properties of the host lattice over a fairly wide range of variation of mass and force constant. Others are that, in general, the absorption spectrum is not simply related to the phonon spectrum, and that there sometimes exists an approximate low-frequency localized mode. (auth)

6855 SECONDARY ELECTRON EMISSION FROM CLEAN SURFACE OF MOLYBDENUM DUE TO LOW-ENERGY NOBLE GAS IONS. P. Mahadevan, J. K. Layton, and D. B. Medved (General Dynamics/Astronautics, San Diego, Calif.). Phys. Rev., 129: 79-83(Jan. 1, 1963).

Secondary electron yields from clean, polycrystalline, molybdenum bombarded by He^+ and Ar^+ have been measured for the kinetic energy range 100 ev to 2.5 kev. This covers the transition energy region where electron ejection processes depending on the translational energy of the bombarding particle are superposed on those depending on their potential energies. A definite kinetic energy threshold for electron ejection is observed for He^+ at about 500 ev and for Ar^+ at about 700 ev. For He^+, the yield drops as the energy increases to about 500 ev and, thereafter, increases linearly with energy. In the case of Ar^+ γ is relatively insensitive to beam energy up to the kinetic threshold and, thereafter, increases linearly. The agreement between the observed variation of γ with ion kinetic energy and a theoretical calculation of the same is discussed. (auth)

6856 NUCLEAR RELAXATION AS A PROBE OF ELECTRON SPIN CORRELATION. P. A. Wolff (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 129: 84-90 (Jan. 1, 1963).

Adiabatic demagnetization of a nuclear spin system produces a state in which there is considerable correlation between neighboring spins. This correlation affects the nuclear relaxation rate and, in metals, where nuclei relax via interaction with conduction electrons, can be used as a probe of spin correlation in the electronic system. For a given lattice temperature the ratio δ of low- to high-field relaxation rates can be written in the form $\delta = 2 + \eta$, where η is essentially the electron spin correlation function at the nearest neighbor distance. η can also be related to the non-

local electron spin susceptibility. For noninteracting electrons, calculated values of η are more than an order of magnitude too small to explain the observations ($\eta \sim 0.2$ in the alkalis). The electronic spin correlation is considerably enhanced by exchange. Calculations which include this effect yield the value 0.1 for η. (auth)

6857 CRITICAL MAGNETIC FIELDS OF SUPERCONDUCTING MOLYBDENUM. R. A. Hein (Naval Research Lab., Washington, D. C.), J. W. Gibson, M. R. Pablo, and R. D. Blaugher. Phys. Rev., 129: 136-7(Jan. 1, 1963).

Critical magnetic fields of two specimens of molybdenum have been measured down to 0.12°K. Sample A with a listed impurity content of less than 27 parts per million was measured as received. Its transition temperature in zero applied magnetic field is 0.958°K and its critical magnetic field at the absolute zero of temperature (H_0) is 99.7 G. Sample B was formed by the levitation melting of a sample similar to Sample A. Its T_C and H_0 are 0.930°K and 98.2 G, respectively. The shapes of the transitions, observed in the presence of an externally applied magnetic field, indicate that these two samples are "soft" or "Meissner-type" superconductors. A calculation which takes into account the fact that the critical field curve is not strictly parabolic leads to values for γ, the electronic specific heat coefficient, of 1.59 and 1.61 mJ/mole-deg^2 for Samples A and B, respectively. (auth)

6858 EMISSION SPECTRA OF KCl:Tl, KBr:Tl, AND KI:Tl AT 300, 80, AND 12°K. R. Edgerton and K. Teegarden (Univ. of Rochester, N. Y.). Phys. Rev., 129: 169-74 (Jan. 1, 1963).

Emission spectra have been measured for single crystals of KCl, KBr, and KI doped with about 0.01 mole % thallium. The measurements were made at 300, 80, and 12°K. Several new bands observed at 12°K are reported. An emission band which is centered directly on the A-absorption band is shown to be present in KI:Tl and KBr:Tl as well as KCl:Tl. An energy level scheme is suggested to explain the observed emission. (auth)

6859 THEORY OF MAGNETOTHERMOMECHANICS. D. C. Mattis and T. D. Schultz (International Business Machines Corp., Yorktown Heights, N. Y.). Phys. Rev., 129: 175-81(Jan. 1, 1963).

It is shown that in both ferromagnetic and antiferromagnetic systems with weak magnetostrictive coupling the coefficient of thermal expansion gives a useful measure of the magnetic specific heat. The strong coupling situation is also analyzed by means of a simplified but soluble model, and it is possible to introduce an effective temperature T^* and an effective magnetic susceptibility. The exact pressure dependence of the thermodynamic functions can be found, and the pressure dependence of the Curie temperature is given explicitly. In strong coupling, a novel first-order thermodynamic phase transformation can occur which is manifested by a discontinuity in T^* as a function of T. An equal area rule for determining the transition is derived, which is reminiscent of the laws of condensation of nonideal gases. It is also shown that in its simple version the theory is not directly applicable to a one-dimensional chain, which is separately analyzed in an Appendix. (auth)

6860 SUPERCONDUCTIVITY OF SOLID SOLUTIONS OF NOBLE METALS. T. H. Geballe, B. T. Matthias, V. B. Compton, E. Corenzwit, and G. W. Hull, Jr. (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 129: 182-3(Jan. 1, 1963).

The superconducting properties of Os-Ir and W-Pt solid solutions have been investigated and the transition temperatures have been determined as a function of composition and of valence electron concentration. Both terminal solid solutions in the Os-Ir system are superconducting. For the same valence electron concentration the face-centered cubic Ir solid solution has a higher transition temperature than the hexagonal close-packed Os solid solution. Both the body-centered cubic W solid solutions and the face-centered cubic Pt solid solutions are superconducting. (auth)

6861 EXCITATION OF ATOMIC HYDROGEN BY FAST PROTONS. M. H. Mittleman (Univ. of California, Livermore, Berkeley). Phys. Rev., 129: 190-3(Jan. 1, 1963). (UCRL-6808-T(Rev.)).

The excitation of the metastable state (2S) of atomic hydrogen by fast protons is discussed. The direct excitation cross section of 2S is calculated from a coupled set of equations (1S, 2S, 2P). The indirect population of the 2S state by excitation to higher states with subsequent cascade to the 2S state is described by Born approximation. The calculation is shown to apply to a fast crossed beam experiment. (auth)

6862 THEORY OF ELECTRON CAPTURE BY MOLECULES: DISSOCIATIVE ATTACHMENT. Joseph C. Y. Chen (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 129: 202-10(Jan. 1, 1963). (BNL-6307)

An elementary process for electron capture by molecules, namely, dissociative electron attachment, is investigated, and a general method is given for calculating the cross section for such a process. Application of this method is carried out for the reaction $H_2 + e \rightarrow H^- + H$ with both H^- and H in their ground states. The calculated cross section–energy curve agrees satisfactorily with the experimentally observed curve. (auth)

6863 RESONANT ELECTRON CAPTURE AND STRIPPING IN $Ne^+ - Ne$ COLLISIONS AT ENERGIES OF SEVERAL kev. P. R. Jones, P. Costigan, and G. Van Dyk (Univ. of Massachusetts, Amherst). Phys. Rev., 129: 211-18(Jan. 1, 1963).

Measurements have been made for collisions in which Ne^+ ions are incident upon neutral Ne atoms. The incident ions ranged in energy from 0.80 to 15 kev and were scattered through angles of from 3° to 13° in the laboratory coordinates. The target atoms were present in the form of a gas at a pressure sufficiently low to insure that the bulk of the scattered particles reaching the detectors had experienced only a single encounter with a target atom. Analysis of the scattered incident particles shows that the relative probabilities for electron capture, scattering without change of charge, and single electron stripping all oscillate rapidly as a function of scattering angle. This behavior is evidently the result of resonance of the $Ne^+ - Ne$ system between the attractive and repulsive states characteristic of the homonuclear, diatomic molecular ion. The data are discussed in terms of this interpretation, and experimental values are presented for the energy difference $(E_r - E_a)$ integrated over the collision path of relative motion, E_r and E_a being the energies of the repulsive and attractive states, respectively. For the range of collisions studied, this integrated energy difference ranged from about 15 ev-Å to about 120 ev-Å. An approximate functional dependence of $(E_r - E_a)$ upon internuclear separation is obtained from the data. (auth)

6864 IONIZATION OF NITROGEN AND OXYGEN MOLECULES BY NITROGEN AND OXYGEN MOLECULES. Nyle G. Utterback (Univ. of Denver). Phys. Rev., 129: 219-24(Jan. 1, 1963).

The ionization cross sections for N_2 and O_2 molecules on impact with N_2 and O_2 molecules have been measured over

the laboratory energy range from 20 to 1000 ev. The incident molecular beams were produced by the technique of ionization by electron impact, electrostatic acceleration, and neutralization by charge transfer. The measurements were carried out in a low-pressure parallel plate ionization chamber. Particular attention was paid to the problem of secondary electrons. Ionization was observed a few ev above threshold for all combinations. Cross sections which were obtained ranged from 10^{-20} to 5×10^{-16} cm^2. The N_2-O_2, O_2-N_2, and O_2-O_2 curves of cross section vs incident particle energy showed no apparent structure, as contrasted with N_2-N_2 case. The N_2-O_2 and O_2-N_2 results were in agreement when corrected to center-of-mass energy. (auth)

6865 MAGNETIZATION AND CRITICAL SUPERCURRENTS. Y. B. Kim, C. F. Hempstead, and A. R. Strnad (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 129: 528-35(Jan. 15, 1963).

The magnetization in high-field superconductors has been investigated using tubular samples. When the sample assumes a critical state, wherein every region of the sample carries critical current density J(B) determined only by the local magnetic field B, the magnetization can be predicted quantitatively from the critical current density J(B). Using observed magnetization data, a critical current density relation $\alpha/J = B_0 + B$ is deduced for Nb_3Sn and 3Nb-Zr. Alpha is a direct measure of the current carrying capacity of a sample, and B_0 coincides approximately with the thermodynamic critical field of the material. Since this relation implies $JB = \alpha = \text{const}$ for $B \gg B_0$, the Lorentz force plays an important role in determining the critical current density. (auth)

6866 INTENSITY DEPENDENCE OF X-RAY INDUCED STRAIN AND COLORATION IN KCl AT ROOM TEMPERATURE. Edward Abramson and M. E. Caspari (Univ. of Pennsylvania, Philadelphia). Phys. Rev., 129: 536-50(Jan. 15, 1963).

The rate of generation of F centers and the induced external strain rate of Harshaw KCl crystals irradiated at room temperature with 46-kvp x rays have been investigated as a function of the incident radiation power density. The influence of linear plastic deformation on these two rates has also been studied. The F-center concentration was determined by standard optical techniques, and the radiation-induced strain was measured by using a capacitance-type, temperature-compensated dilatometer with a sensitivity of approximately 1 Å. It was found that the rate of slow-stage F-center generation varied as the 1.4 power of the incident intensity, in substantial agreement with the results reported by Mitchell, Wiegand, and Smoluchowski, and that the strain rate varied linearly with the intensity. A further set of experiments in which the ratio of the slow-stage F-center generation rate to the strain rate was investigated directly yielded the observation that this ratio varied as the approximately 0.7 power of the intensity. These three intensity dependences are consistent within experimental error. The discrepancy between the intensity dependences of the rates of coloration and vacancy generation is explained on the basis of a significant self-bleaching of radiation-induced color centers as reported by Schultz. The deformation experiments yielded the observation that, for the crystals used, deformation had a negligible effect on the coloration rate. From this observation and from a comparison of the observed strain rate with that predicted by the various mechanisms for defect generation by ionizing radiation which have been proposed in the literature it is suggested that the predominant mechanism, at least for the crystals used in this study, is most likely one of the bulk multiple ionization mechanisms initiated by an inner shell ionization followed by an Auger transition. (auth)

6867 ADIABATIC APPROXIMATIONS AND SUPERCONDUCTIVITY THEORIES. Robert Englman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev., 129: 551-3 (Jan. 15, 1963).

In a number of recent suggestions for a theory of superconductivity a variant of the conventional perturbation theory was used to treat the lattice-electron interaction in crystals and to obtain apparently new results which were different from the theory proposed earlier by Fröhlich. It is demonstrated that the variant theory, which uses the same matrix elemeents as Fröhlich, gives identically the same correction to the energy of the crystals as does the Fröhlich theory and that the apparently new results stem from erroneous neglect of the renormalization of the sound frequencies and of the zero-point motion. (auth)

6868 NUCLEAR MAGNETIC RESONANCE IN SOLID HELIUM-3. Haskell A. Reich (IBM Watson Lab., New York). Phys. Rev., 129: 630-43(Jan. 15, 1963).

Nuclear magnetic resonance experiments have been performed in solid He^3 at constant molar volumes in the α and β phases at various magnetic fields and temperatures by the spin echo method. The self-diffusion coefficient D as well as the relaxation times T_1 and T_2 have been determined. D is observed to obey the Arrhenius equation as the temperature is lowered in the α phase, but at a low enough temperature it becomes temperature independent and depends only on the density. The activation energy for diffusion correlates well with that determined from specific heat measurements. At high magnetic fields T_1 and T_2 are observed to obey the Bloembergen, Purcell, and Pound relationships characteristic of relaxation caused by diffusion. At low magnetic fields, T_1 becomes temperature independent as the temperature is lowered, and is observed to depend on magnetic field as $\exp(H^2/H_0^2)$, implying that the relaxation is from Zeeman to exchange systems. Values of the exchange integral J are deduced from temperature-independent diffusion, field-dependent relaxation, and rigid-lattice values of T_2, and show fair agreement internally. No agreement can be obtained with values of J deduced from observations of departures from Curie's law, the values reported being much smaller. (auth)

6869 THEORY OF THE INTRINSIC ELECTRONIC THERMAL CONDUCTIVITY OF SUPERCONDUCTORS. Ludwig Tewordt (Univ. of Notre Dame, Ind.). Phys. Rev., 129: 657-63(Jan. 15, 1963).

The analog to the Bloch equation for the case of thermal conduction in a superconductor limited by phonon scattering is derived by introducing an appropriate general form for the nonequilibrium part of the distribution function into the corresponding Boltzmann equation. This integral equation for the deviation function is solved numerically for different temperatures T by replacing it by sets of simultaneous linear equations with dimensions up to 39. The limiting curve for the deviation function when T approaches the transition temperature T_c from below turns out to be identical to the curve which has been reported by Klemens for the normal state. With T decreasing below T_c the maximum of the deviation function rises and shifts to higher energies. The ratio of the thermal conductivity in the superconducting state to that in the normal state, κ_s/κ_n plotted against T/T_c is found to increase monotonically and to have a limiting slope of about 1.62 at T_c. Consideration of the energy dependence of the energy gap in the case of lead yields a sizable effect on the plot of κ_s/κ_n vs T/T_c. (auth)

6870 PHOTOELECTRIC K-ABSORPTION CROSS SECTION OF BERYLLIUM. T. J. Peterson, Jr., E. J. McGuire, and D. H. Tomboulian (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 129: 674-7(Jan. 15, 1963).

The continuous photoelectric absorption cross section of Be has been measured for photon energies extending from the K edge energy, at 110 ev, to 180 ev. The measurements were carried out by the application of technical improvements which included a more precise electronic method for determining the surface density of absorbers and auxiliary equipment for transferring samples into the spectrograph without exposure to air. The theoretical results of the atomic photo-ionization cross section are also included for reference. The present data are compared with earlier measurements. The cross section ranges from a value of 1.01 Mb at 99.6 Å to a value of 0.63 Mb at 71.5 Å. (auth)

6871 THEORY OF SECOND SOUND ABSORPTION IN ROTATING HELIUM. John R. Pellam (California Inst. of Tech., Pasadena). Phys. Rev. Letters, 9: 281-3(Oct. 1, 1962).

An explanation is proposed for the additional second sound attenuation observed experimentally in rotating liquid helium II. The approach relies upon the over-all Feynman concept of rotating liquid helium. Losses are attributed to interactions between the second sound waves and the local, irrotational regions of superfluid implicit to that concept. This treatment allows the observed behavior to be derived directly, without introducing fundamental physical constants or reliance upon undetermined or adjustable vortex parameters. (H.D.R.)

6872 ABSENCE OF AN ISOTOPE EFFECT IN SUPERCONDUCTING RUTHENIUM. D. K. Finnemore and D. E. Mapother (Univ. of Illinois, Urbana). Phys. Rev. Letters, 9: 288-90(Oct. 1, 1962).

The superconducting isotope effect is examined in five Ru specimens by measurements of the bulk magnetization, which show the effect of isotopic composition on the superconducting critical field. All specimens showed excellent superconducting behavior, and a typical series of isothermal transitions is plotted. To avoid uncertainty associated with absolute temperature measurements, the isothermal critical field differences of four of the specimens was measured relative to one specimen used as a reference. The data confirm that the superconducting isotope effect does not occur in Ru and indicate that, if Ru has any isotope effect at all, it must be at least an order of magnitude smaller than that shown by the nontransition superconducting elements. (H.D.R.)

6873 ULTRA-HIGH-FIELD SUPERCONDUCTIVITY. V. Jaccarino and M. Peter (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters, 9: 290-2(Oct. 1, 1962).

In a rare earth ferromagnetic metal the effective exchange field (H_{eff}) impressed on the conduction electrons is in general so large as to inhibit the occurrence of superconductivity in zero external field H. A discussion is presented to point out that in certain ferromagnetic metals H_{eff} opposes H and allows conduction electron polarization to be canceled so that, if these metals also possess a predominantly attractive electron-electron interaction, the possibility arises that superconductivity will occur in the compensation region. Since the cancellation will presumably occur for $H \sim -H_{eff}$, critical fields may be obtained that exceed the limit derived for ordinary superconductors by an order of magnitude. (H.D.R.)

6874 UPPER CRITICAL FIELDS OF TRANSITION METAL ALLOY SUPERCONDUCTORS. T. G. Berlincourt and R. R. Hake (Atomics International, Canoga Park, Calif.). Phys. Rev. Letters, 9: 293-5(Oct. 1, 1962).

An interpretation is presented of the persistence of superconductivity of transition metal alloys at very high magnetic fields. The interpretation is based on pulsed-magnetic-field data on the low-current-density resistive critical fields of concentrated transition metal alloys, the Ginsberg-Landau-Abrikosov-Gor'kov theory, and a paramagnetically limited critical-field criterion. The arguments add weight to previous evidence of a negative-surface-energy picture for alloy superconductors with short electronic mean-free-path. (H.D.R.)

6875 CRITICAL PERSISTENT CURRENTS IN HARD SUPERCONDUCTORS. Y. B. Kim, C. F. Hempstead, and A. R. Strnad (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters, 9: 306-9(Oct. 1, 1962).

Persistent currents induced in hard superconductors (HSC) were investigated by measuring the resulting magnetic effects. The tubular HSC examined were Nb powder, Nb_3Sn, and 3Nb–Zr samples of uniform wall thickness and length large compared to the diameter. Experimental evidence is presented that in HSC the Lorentz force plays a crucial role in determining the critical current density and the critical persistent currents in decay with a measurable rate. (H.D.R.)

6876 THEORY OF FLUX CREEP IN HARD SUPERCONDUCTORS. P. W. Anderson (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters, 9: 309-11(Oct. 1, 1962).

Previous investigations of the critical state of the hard superconductor have defined it in terms of constants α and B_0: $\alpha(T) = J_{cr}(B_{cr} + B_0)$. If the current density J or the field B is increased beyond the critical values, a process called "flux creep" sets in, and flux leaks through the material and returns it to the critical state. $\alpha(T)$ is a structure-sensitive constant of the material. A theory is presented to show that this behavior of α can be explained by assuming that the mechanism of flux creep is thermally activated motion of bundles of flux lines, aided by the Lorentz force, over free energy barriers coming from the pinning effect of inhomogeneities, strains, dislocations, or other physical defects. The theory also explains B_0, and predicts time relaxation behavior similar to those of magnetic aftereffect and some forms of plastic creep. (H.D.R.)

6877 ENERGY GAP AND CRITICAL FIELD OF SUPERCONDUCTING MOLYBDENUM OBTAINED BY ULTRASONIC MEASUREMENTS. Norman H. Horwitz and Henry V. Bohm (Wayne State Univ., Detroit). Phys. Rev. Letters, 9: 313-14(Oct. 1, 1962).

A molybdenum single crystal prepared by electron-beam zone refining was examined using ultrasonic measurements. Longitudinal pulses of 239-Mc/sec were propagated along the [100] crystallographic direction at temperatures from 1.1 to 0.5°K to obtain energy gap and critical field data. The critical field at absolute zero was determined as 114 ± 5 oersteds. Measurements of the ultrasonic attenuation as a function of temperature give 3.5 ± 0.2 kT_c units for the energy gap at absolute zero. Critical field measurements on a pure zinc single crystal yielded a value of 55 ± 3 oersteds. (H.D.R.)

6878 ENERGY GAP IN SUPERCONDUCTORS CONTAINING PARAMAGNETIC IMPURITIES. F. Reif and Michael A. Woolf (Univ. of California, Berkeley). Phys. Rev. Letters, 9: 315-16(Oct. 1, 1962).

Experiments were performed on quenched alloy films evaporated onto substrates maintained at 4°K to investigate the energy gap and density of states of semiconductors

containing paramagnetic impurities. Preliminary results are presented from an investigation by tunneling techniques. For paramagnetic impurity concentrations greater than a relatively small value, the superconductor no longer exhibits an energy gap in its tunneling characteristics, although resistance measurements show that it has a well-defined transition temperature in accord with the expected concentration dependence. (H.D.R.)

6879 COMMENTS ON OBSERVING VIRTUAL LOCALIZED MODES USING THE MÖSSBAUER EFFECT. G. W. Lehman and R. E. De Wames (North American Aviation Science Center, Canoga Park, Calif.). Phys. Rev. Letters, 9: 344-5(Oct. 15, 1962).

A previous work has pointed out that the cross section for absorption of gamma rays will have a peak at a frequency ω_0 of half-width K arising from the isotopic substitution of a heavy Mössbauer atom in a light host lattice. Presented is the entire gamma absorption cross section, $\sigma_a(E)$, for the case considered in the previous work, and an experiment using the Mössbauer effect is suggested to pick up the approximate eigenstate. Values are tabulated for the dips for the first phonon transition for Au^{197} and Ir^{193} in Be lattices and Tm^{169} in a molecular crystal of low Debye temperature. (H.D.R.)

6880 ELECTRON DETACHMENT FROM NEUTRAL HYDROGEN BY A MAGNETIC FIELD. Selig N. Kaplan, George A. Paulikas, and Robert V. Pyle (Univ. of California, Berkeley). Phys. Rev. Letters, 9: 347-8(Oct. 15, 1962). (UCRL-10430)

Magnetic-field electron detachment from fast neutral beams of hydrogen atoms in excited states produced by gas-collisional breakup of molecular ions is measured. The hydrogen atoms were produced by 20 Mev H_2^+ ions from the Berkeley heavy-ion linear accelerator, and analysis was performed by activating Cu foils placed perpendicular to the incident beam. The fractional electron detachment versus magnetic and equivalent electric fields is shown up to a maximum magnetic field of 19 kilogauss. The electric field detachment from charge exchange is shown for comparison. (H.D.R.)

6881 THE ATTENUATION OF SECOND SOUND IN FLOWING He II IN WIDE CAPILLARIES. Howard A. Snyder (Brown Univ., Providence). Physica, 28: 1170-2(Nov. 1962). (In English)

An apparatus is considered in which a chamber is connected to a He II bath by a superleak path and a wide capillary path. The flow in the capillary is divisible into three regions, depending on the Reynolds number (Re_n) of the normal fluid, namely: a region in which the pressure drop (Δp) in the capillary is proportional to both the chamber–bath temperature difference (ΔT) and the average flow velocity (v_n) of the normal fluid; one in which Δp is proportional to ΔT but not to v_n; and one in which Δp is not proportional to either ΔT or v_n. The correlation of these results with data on second-sound attenuation in the same apparatus, also as a function of Re_n, is investigated. It is found that the data may be interpreted in terms of two distinct types of turbulence in the capillary flow. (T.F.H.)

6882 THE QUENCHING OF ORTHO-POSITRONIUM IN HELIUM. B. G. Duff and F. F. Heymann (University Coll., London). Proc. Roy. Soc. (London), Ser. A, 270: 517-24(Dec. 11, 1962).

The lifetime of ortho-positronium is measured in helium at high pressures, yielding a mean quenching rate per atmosphere of 0.0123 Λ_0. (Λ_0 is the natural annihilation rate of ortho-positronium.) This small quenching rate can be explained qualitatively by a pick-off process, in which the positron of the positronium atom annihilates with an electron in the helium atom during a collision. Lifetimes are also measured in argon at a range of pressures and in freon at subatmospheric pressures. (auth)

6883 THE GROUND STATE OF LIQUID He^4. Fa Yueh Wu and Eugene Feenberg (Washington Univ., St. Louis). Prog. Theoret. Phys. (Kyoto), 28: 568-9(Sept. 1962).

In a recent study of liquid He^4 (Wu and Feenberg, Phys. Rev. 122,739) the virial theorem was used to determine the range and strength parameters in several 6-n type interatomic potentials. Comments are presented on the criticism of the study by Hiroike (Prog. Theor. Phys. 27,342.). (W.D.M.)

6884 MAGNETIC SUSCEPTIBILITY MEASUREMENTS OF SMALL SAMPLES. II. SOLUTIONS. R. G. Gordon (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr., 33: 1167-8(Nov. 1962).

A microtechnique for measuring the magnetic susceptibility of paramagnetic compounds in solution is described. Solutions containing less than 10^{-3} mole of solute have been measured, which represents a sensitivity increase of more than 10^4 over the classical Gouy method. The method depends upon balancing magnetic forces in an inhomogeneous magnetic field against density gradients in the solution. (auth)

6885 CENTRAL FORCES IN RELATIVISTIC MECHANICS. F. Alsina. Rev. Union Mat. Arg., 19: 326-37 (1962). (In Spanish)

The Lorentz transformations applied to central forces of any type produce relativistic correction terms of the "transverse" type, which, in the particular case of electrical forces, give the well known total Lorentz force acting on moving charges. The field functions are introduced in order to show that the differential equations introduced by Maxwell are identities of very general validity applicable, among others, to electrical or gravitational phenomena, and whose deduction is immediate. (tr-auth)

6886 KINETICS OF GAMMA CONDUCTIVITY IN CADMIUM SULFIDE CRYSTALS. P. G. Litovchenko and V. I. Ust'yanov (Physics Inst., Academy of Sciences, Ukrainian SSR, Kiev). Soviet Phys.-Solid State (English Transl.), 4: 1241-4(Jan. 1963).

The results of an experimental study of the kinetics of gamma conductivity in cadmium sulfide crystals at room temperature are outlined. It is shown that the kinetic effects are governed essentially by the state of the impurity centers in the crystal and the gamma intensity. The effect of the intensity and wavelength of light incident on the crystal on the change in the rate and nature of the excitation buildup and decay of nonequilibrium gamma radiation is demonstrated. (auth)

6887 MANY-PARTICLE QUANTUM GREEN'S FUNCTIONS IN THE THEORY OF MULTI-PHONON TRANSITIONS. P. K. Katana (Kishinev State Univ., USSR). Soviet Phys.-Solid State (English Transl.), 4: 1255-9(Jan. 1963).

The possibility of an exact representation of the many-particle quantum Green's functions of the theory of multi-phonon transitions in terms of the simplest functions φ and Δ of the theory is demonstrated. For the proof, the Green's functional σ and the corresponding equation are constructed. An exact solution of the equation is found. (auth)

6888 ON THE QUESTION OF ANOMALY IN THE DECAY OF μ^--MESONS IN MESIC ATOMS OF TRANSITION METALS OF THE IRON GROUP. L. B. Egorov, A. E. Ignatenko, A. V. Kuptsov, and M. G. Petrashku (Joint Inst.

of Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1149-53(Oct. 1962). (In Russian)

By the method of scintillation counters, relative measurements are made of the decay probabilities of μ^- mesons in mesic atoms of iron and zinc and also nickel and copper. The results of measurements indicate an absence of anomaly observed by a number of authors. Equality, within the limits of errors of the experiment, of the yield of γ rays from the above-mentioned targets indicates that the instrument effect is not the cause of the anomaly observed. (auth)

6889 ULTRASONIC SPLITTING OF MÖSSBAUER LINE OF ABSORPTION IN TIN OXIDE $Sn^{119}O_2$. V. A. Burov, V. A. Krasilnikov, and O. Yu. Sukharevskaya (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1184-5(Oct. 1962). (In Russian)

Splitting of the Mössbauer line of absorption in tin oxide $Sn^{119}O_2$ deposited on a piezoquartz plate with a natural frequency of 20 megacycles per second is obtained at ultrasonic oscillations of the absorber with a frequency of 18.5 megacycles per second. The intensity of lines of the first, second, and third orders increases with increasing voltage applied to the piezoquartz plate, and their position is in good agreement with the frequency of the acoustic excitation. (auth)

6890 ON THE THEORY OF ABSORPTION OF ULTRASOUND IN SUPERCONDUCTORS. I. A. Privorotskii. Zh. Eksperim. i Teor. Fiz., 43: 1331-8(Oct. 1962). (In Russian)

The peculiarities are investigated of the absorption of ultrasound in superconductors, which are associated with two mechanisms of phonon scattering: absorption of the phonon by an electron and the decay of a phonon into a pair of quasi-particles. It is shown that the derivative of the absorption coefficient with respect to temperature in the critical point is finite. In the isotropic model, the absorption coefficient undergoes a finite jump below the transition temperature; however, this jump is absent in an anisotropic superconductor. For high ultrasonic frequencies, the absorption coefficient increases with decreasing temperature. (auth)

6891 ON THE POSSIBILITY OF A NEW METHOD FOR INVESTIGATING THE STATISTICAL BEHAVIOR OF LINEAR SYSTEMS. M. I. Podgoretskii. Zh. Eksperim. i Teor. Fiz., 43: 1349-57(Oct. 1962). (In Russian)

A new approach to the statistical behavior of linear systems is described. For comparison with the kinetic equation method and the so-called "direct summation" method, some problems are considered which have not been solved by these two methods. (auth)

6892 ON SINGULARITIES IN THE LAW OF DISPERSION OF PHONONS ASSOCIATED WITH ELECTRON-PHONON INTERACTION. A. M. Afanasev and Yu. Kagan. Zh. Eksperim. i Teor. Fiz., 43: 1456-63(Oct. 1962). (In Russian)

Through the use of Green's functions, an analysis is made of singularities in the law of phonon dispersion due to electron-phonon interaction. It is shown that the nature of the singularities is significantly associated with the form of the Fermi surface. If one of the radii of curvature is great (for example, Fermi surfaces close to cylindrical), then in place of a logarithmic singularities in the derivative of the frequency with respect to the wave vector, a root singularities appears. If both radii of curvature (Fermi surfaces close to flat) are great, a singularity of the form $1/x$ appears. In the latter case, there will also be a substantial absolute rearrangement of the spectrum. (auth)

6893 ON THE HEAT ANOMALY OF SUPERCONDUCTORS. I. O. Kulik (Inst. of Low Temperature Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1489-92(Oct. 1962). (In Russian)

The change of the dispersion law of phonons at the superconducting transition is calculated. It is shown that this change cannot account for the experimentally observed anomaly of lattice specific heat of superconductors. (auth)

6894 LIMITATION IN THE AMPLITUDE ATTENUATION RATE FOR VARIOUS PROCESSES. V. N. Gribov and I. Ya. Pomeranchuk. Zh. Eksperim. i Teor. Fiz., 43: 1556-9(Oct. 1962). (In Russian)

It is shown that in relativistic theory the partial wave amplitudes $f_l(t)$ at arbitrary t have a certain singularity at $\mathrm{Re}\, l \geq -1$, consequently the amplitude A(s,t), cannot drop at any t, faster than $1/s$. This holds for amplitudes of any two-particle processes due to the presence of three Mandelstam functions, in relativistic amplitude, that induce peculiarities near negative integral l. These singularities are the poles condensed at these points, thus, the points are singular in themselves. In order to verify the above postulation an analysis was made of the expression for the partial wave amplitude. (R.V.J.)

6895 INVESTIGATIONS OF He(II) ROTATION NEAR λ POINT BY MEANS OF SECOND SOUND. E. L. Andronikashvili, Zh. S. Thikadze, and R. A. Bablidze (Inst. of Physics, Academy of Sciences, Georgian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1562-3(Oct. 1962). (In Russian)

Delayed stationary motion in transition from rotating He(I) to rotating He(II) (delayed Onsager-Feynman vortex) was studied using second sound scattering on the vortex. Measurements made at 2.15°K showed that the maximum second sound amplitude does not vary, confirming the delayed vortex formation. Increased temperature (not above λ) and reduction to 2.15°K reduces the second sound amplitude. At 2.09°K the second sound amplitude is attenuated about 20% from the initial. The difference between the cooling time from the λ point to 2.15°K in one case and to 2.09°K in the other determines the delay in vortex formation in the transition. The unconfirmed data indicate the delay time is of the order of 4 min at 2.15°K. (R.V.J.)

6896 CROSS SECTION FOR DISSOCIATION OF 3.5–100 kev D_2^+ IONS IN COLLISIONS WITH D_2 MOLECULES. S. E. Kupriyanov, A. A. Perov, and N. N. Tunitskii (Karpov Inst. of Physics and Tech., Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1636-7(Nov. 1962). (In Russian)

The cross sections for deuteron formation resulting from the dissociation of D_2^+ ions with energies between 3.5 and 100 kev colliding with D_2 molecules were determined using a double mass spectrometer. The shape of the dependence of the cross section on D_2^+ ion energy is in accordance with the data of Fedorenko et al. but is approximately 30% lower. (auth)

6897 RADIATIVE CORRECTIONS TO ENERGY LOSSES OF PARTICLES IN A MEDIUM. V. N. Tsytovich (Levedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1782-94(Nov. 1962). (In Russian)

Energy losses of particles in a medium are investigated by taking into account radiative corrections. It is shown that the macroscopic part of the radiative losses due to the presence of the medium may be very significant and comprise about 7% of the total losses. A density effect applies to the radiative corrections and occurs at energies larger than those at which the density effect in the main part of the losses arises. It is predicted that a decrease of ionization

energy losses of about ~7 to 10% should occur on the Fermi plateau. The theoretical results are compared with the experimental. The problem of radiative corrections to Cherenkov radiation is discussed. (auth)

6898 STEADY MAGNETOHYDRODYNAMIC FLOW PAST A NON-CONDUCTING WEDGE. C. K. Chu and Y. M. Lynn (New York Univ., New York). Preprint 2616-62. New York, American Rocket Society, 1962. 14p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

A study is presented of the steady two-dimensional magnetohydrodynamic flow of an infinitely conducting fluid past a non-conducting wedge with non-aligned flow and magnetic field. The flows considered are in the "superfast" or fully hyperbolic regime. The flows consist of several regions of uniformity, connected by shocks and expansion waves. Because of the boundary condition on the magnetic field, the magnetic field must be the same in the regions above and below the wedge; thus the flows in these regions are coupled, in contrast to the case of ordinary supersonic gas dynamics. Only small wedge angles and weak waves are considered. The problem is thus linearized, and explicit solutions are obtained that are qualitatively similar to the nonlinear solutions. Some interesting features that arise are discussed. (auth)

6899 BOUNDARY LAYER RESISTANCE AND THE SHEATH POTENTIAL IN A SHOCK TUBE. D. L. Turcotte and James Gillespie (Cornell Univ., Ithaca, N. Y.). Preprint 2634-62. 12p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

The boundary-layer resistance and sheath potential is measured in shock-heated air. Using a single-wall probe, the voltage drop across the wall boundary layer is measured as a function of the distance behind the incident shock for applied voltages from −6 to +6 volts. All measurements are carried out at a shock velocity of 4.35 mm/μsec in a pressure-driven shock tube with an initial pressure of one mm Hg. The boundary-layer resistance of a one-quarter-inch-square electrode increases from 2kΩ directly behind the shock to 0.5 megohms 30 cm behind the shock. The sheath potential first increases and then decreases behind the shock, and is of the order of one volt. To correlate the measurements with theory, it is necessary to include electron-ion recombination, ambipolar diffusion, and the sheath in a boundary-layer theory. The recombination can be accounted for if the change from equilibrium flow to frozen flow is assumed to occur under conditions based on measured rate data. Since the Debye length is greater than the mean free path, sheath analysis is not valid. A continuum theory gives a solution for the sheath in which the potential is a function only of temperature. The magnitude of the potential is in agreement with experiment. (auth)

6900 STUDIES OF A GAS DISCHARGE CESIUM ION SOURCE. R. C. Speiser and L. K. Branson (Electro-Optical Systems, Inc., Pasadena, Calif.). Preprint 2664-62. New York, American Rocket Society, 1962. 20p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

The characteristics of an electron-bombardment ion source using cesium as an expellant are studied. The arc characteristics and operation of the source are consistent with analytical considerations and no anomalies are observed. Cathode configurations heated entirely by power delivered from the arc provide mass utilization efficiencies of 90% at about 650 ev/ion. In an engine configuration this type source may achieve overall engine efficiencies of 70 to 80% at specific impulses of 6000 to 8500 seconds. (auth)

6901 THE INFLUENCE OF CHARGE SEPARATION AND CURRENT INERTIA ON MAGNETOHYDRODYNAMIC SHOCK STRUCTURE. J. E. Anderson (Minneapolis-Honeywell Regulator Co., Minneapolis). Preprint 2615-62. New York, American Rocket Society, 1962. 14p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

Analyses of the structure of shock waves in conducting fluids in the presence of magnetic fields may be based on the continuum equations of magnetohydrodynamics. The problem of extension of the range of validity of the continuum solutions to rarer gases is discussed. The study begins in an examination of the fundamental equations of magnetohydrodynamics, and it is found for the shock-structure problem that the entire generalized Ohm's law must be used, and that charge separation cannot be neglected. With these effects included in a treatment of shocks for which the collision frequency is larger than the cyclotron frequency, it is found that there can be flow oscillations caused by both charge separation and current inertia. Criteria are given from which it can be determined when such oscillations will occur. (auth)

Astrophysics and Cosmology

6902 (EFINS-62-50) METEORITES AND THE EARLY HISTORY OF THE SOLAR SYSTEM. Edward Anders (Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies). Aug. 1962. Contract [AT(11-1)-382]. 89p.

The early thermal history of meteoritic matter is discussed. Clues obtained from the mineralogy of the carbonaceous chondrites are described. An attempt was made to establish the origin of the high-temperature minerals that served as the starting material for carbonaceous chondrites and the possible settings for the aqueous stage of the minerals. The occurrence of primordial noble gases in the meteorities is discussed. Chemical fractionations in the chondrites, extinct radioactivity, and general isotopic anomalies are also discussed. A series of possible events in the history of the solar system, based on the conditions discussed, is presented. (M.C.G.)

6903 THE INTENSITY OF FORBIDDEN EMISSION LINES. Guido Muench (Carnegie Institution of Washington, D. C. and California Inst. of Tech., Pasadena). Astrophys. J., 136: 823-31(Nov. 1962).

A general formula for the intensity of a forbidden emission line in a two-level atom is derived, taking into consideration induced emissions, saturation effects, and departures from a Boltzmann distribution. The kinetic temperature is supposedly given, but not necessarily is it taken as constant. It is shown how this general formula embodies expressions used in the past separately for the optical, infrared, and radio regions of the spectrum. As an example of application of the formulae derived, the emission rate in the fine-structure transition of the ground state of C^+ is re-evaluated under the conditions prevailing in interstellar H I regions. As an illustration of a line arising in a medium with variable temperature, the intensity in the normal direction and flux of the line arising between the lowest two fine-structure levels of the ground state of oxygen is computed, under conditions appropriate to the earth's upper atmosphere. It is found that the outward energy flux in this line compares with the energy input provided by solar x rays at the time of low solar activity. (auth)

6904 ENERGY TRANSPORT IN THE HYDROGEN IONIZATION ZONE OF GIANT STARS. Robert F. Christy

(California Inst. of Tech., Pasadena). Astrophys. J., 136: 887-902(Nov. 1962).

The relation of the hydrogen ionization zone to stellar pulsation is discussed. A detailed analysis of the behavior of this zone in SU Draconis, shows that it is an important energy source for driving pulsation. An examination of conditions in other RR Lyrae stars, cepheids, and W Virginis stars suggests that the hydrogen ionization zone is important in determining the phase lag and in driving their oscillation. It is proposed that non-spherical pulsation-type motions, driven by the hydrogen ionization instability, are present in all the late-type giants and supergiants and provide the principal means of energy transport in the hydrogen ionization zone of such stars. These motions could account for indications of variability and supersonic velocities in their photospheres. Numerical calculations have been initiated to develop these ideas further. It is also shown that the dissociation transition of molecular hydrogen may provide the heat sink that is the key to the existence of the class of cool variables that include the Mira and semi-regular red variables. (auth)

6905 RATE OF COLLISIONAL EXCITATION IN STELLAR ATMOSPHERES. Henri Van Regemorter (Univ. of Colorado, Boulder). Astrophys. J., 136: 906-15(Nov. 1962).

An approximate formula is proposed to compute the cross-section for excitation by electron impact for the optically allowed transitions in neutral atoms and in positive ions. Comparison is given with the semiclassical formula of Woolley and Allen. Tables are given of the rate of collisional de-excitation in the main-sequence stars. (auth)

6906 A MODEL FOR THE SOURCES OF THE SLOWLY VARYING COMPONENT OF MICROWAVE SOLAR RADIATION. T. Kakinuma (Nagoya Univ., Japan) and G. Swarup. Astrophys. J., 136: 975-94(Nov. 1962).

A comparison of the observations of the slowly varying component of the solar radio emission made with high-resolution interferometers operating at wavelengths of 3.2, 7.5, 9.1, and 10.7 cm shows that the flux densities of many strong sources are higher at the longer wavelengths than at 3 cm. The same conclusion is derived from eclipse and statistical investigations, which indicate further that the spectrum of the flux density has a peak around 6 cm. The decrease in flux density with frequency cannot be explained simply by assuming a greater optical thickness for the extraordinary wave near 10 cm in the million-degree corona, as given by the magneto-ionic theory, since the observed degree of polarization at 7.5 or 9.1 cm is much lower than that at 3.2 cm. It is suggested that radiation at the gyro-frequency and its harmonics emitted by the thermal electrons in the dense region over a sunspot group should be taken into account to explain the spectrum of the slowly varying component. This mechanism of resonance absorption requires the average strength of the magnetic field over the sunspot group to be about 600 gauss at a height of 2×10^4 km above the photosphere and 250 gauss at a height of 4×10^4 km. In order to explain the observed values of brightness temperature of $1\text{-}4 \times 10^6$ °K near 10 cm by the magneto-ionic theory, it is necessary to assume values of electron density of up to 20 or 40 times the normal. However, these high values of densities are not required by the gyro-theory, and values of five to ten times the normal are sufficient for explaining simultaneously the observations of brightness temperature, flux density, and polarization. This theory also explains the small size of the source in the range 3-10 cm. The radio emission is considered to originate thermally, which requires that the value of the electron temperature in the region of the inner solar corona above a large sunspot group is about $2\text{-}4 \times 10^6$ °K. (auth)

6907 MEASUREMENT OF MICROWAVE RADIATION FROM THE PLANET MERCURY. William E. Howard, III, Alan H. Barrett, and Fred T. Haddock (Univ. of Michigan, Ann Arbor). Astrophys. J., 136: 995-1004(Nov. 1962).

The microwave emission from the planet Mercury has been measured relative to the flux density of three radio sources at wavelengths of 3.45 and 3.75 cm, using the University of Michigan 85-foot reflector with two different radiometers. The measured mean antenna temperature is 0.05°K. From this value a mean equivalent black-body disk temperature of about 400°K is derived. A subsolar point temperature of the planet of 1100° ± 300°K (est. m.e.) at mean solar distance is derived if it is assumed that the temperature distribution of the sunlit surface of Mercury varies as the one-quarter power of cos θ, where θ is the angle of incidence of solar radiation, and that the temperature of the dark hemisphere is zero. A lower subsolar temperature is obtained if radioactive heating and a lunar-type insulating dust layer on the surface are assumed, since the dark hemisphere will then contribute to the mean disk temperature. The effect of orbital libration will also modify the deduced subsolar temperature. (auth)

6908 ON THE ORIGIN OF THE SATELLITES AND THE PLANETS. H. Alfvén and J. M. Wilcox (Royal Inst. of Tech., Stockholm). Astrophys. J., 136: 1016-22(Nov. 1962).

A previously described theory of the origin of the planets and the satellites is summarized and discussed in the light of recent developments. A theoretical assumption about the interaction of a neutral gas and a plasma in relative motion has been supported by experiment. (auth)

6909 INTERPLANETARY GAS. VII. A SEMIEMPIRICAL MODEL. John C. Brandt and Richard W. Michie (Univ. of California, Berkeley). Astrophys. J., 136: 1023-31(Nov. 1962).

A theoretical expression is obtained connecting parameters in the solar wind near the orbit of earth with parameters in the inner corona. A model similar to the empirical model presented recently is found to be reasonably consistent with the theoretical expression. Near the orbit of earth an expansion velocity of 200–400 km/sec and a mean electron density of 1-5/cm^3 are thought to be probable. (auth)

6910 AN ATTEMPT TO MEASURE ZEEMAN SPLITTING OF THE GALACTIC 21-CM HYDROGEN LINE. Sander Weinreb (Massachusetts Inst. of Tech., Cambridge). Astrophys. J., 136: 1149-52(Nov. 1962).

The existence of a galactic magnetic field is presupposed by theories describing the polarization of starlight, the emission of galactic radio noise, and the behavior of cosmic rays. An attempt to measure the field by measuring the Zeeman splitting of the 21-cm hydrogen line is described. The line-of-sight component of the galactic magnetic field causes a splitting of the radiation into left-hand and right-hand circulatory polarized waves with a difference in frequency of 2.8 cps/10^{-6} gauss. (W.D.M.)

6911 THE ABUNDANCE OF He^3 IN THE SUN. Leo Goldberg (Harvard Coll. Observatory and Smithsonian Astrophysical Observatory, Cambridge, Mass.). Astrophys. J., 136: 1154-5(Nov. 1962).

Various investigations on the presence of He^3 in the sun and the isotopic ratio of He^3/He^4 are discussed. Probable errors and discrepancies are noted and a value for the He^3/He^4 ratio is obtained. (W.D.M.)

6912 CYCLOTRON RADIATION FROM JUPITER. G. R. A. Ellis (Univ. of Tasmania, Australia). Australian J. Phys., 15: 344-53(Sept. 1962).

Cyclotron radiation from bunches of electrons trapped in a planetary magnetic field is discussed as a possible cause of the decametric wavelength radio emissions of Jupiter. Under the assumption of the existence of an exospheric ionized medium similar to that of the Earth, many of the observed properties of the radiation may be obtained by this process. (auth)

6913 THE ATTENUATION OF HYDROMAGNETIC WAVES IN THE IONOSPHERE. Robert Karplus, W. E. Francis, and A. J. Dragt (Lockheed Missiles and Space Co., Palo Alto, Calif.). Planetary Space Sci., 9: 771-85(Nov. 1962). (In English)

A numerical integration of the hydromagnetic wave equations in the ionosphere has been carried out for four model atmospheres corresponding to day and night conditions at sunspot maximum and sunspot minimum. The behavior of the solutions is discussed in terms of the steady state stored energy, the energy flux, and the power dissipation density for monochromatic, vertically incident waves between 0.16 and 5 c/s. (auth)

6914 THE CAPTURE OF SMALL ABSORBING PARTICLES BY THE SOLAR RADIATION FIELD. G. T. Best and T. N. L. Patterson (Queen's Univ., Belfast). Planetary Space Sci., 9: 801-9(Nov. 1962). (In English)

Calculations are described which allow conclusions to be made concerning the conditions for capture of small absorbing particles into the solar radiational and gravitational fields. The results are presented in graphical form showing the crossover region between escape and capture as a function of particle size, impact parameter and approach velocity. The applicability of the results is discussed. (auth)

6915 SEARCHES FOR ANTI-MATTER IN COSMIC RAYS AND IN OUTER SPACE. N. L. Grigorov, D. A. Zhuravlev, M. A. Kondrat'yeva, I. D. Rapoport, and I. A. Savenko. Planetary Space Sci., 9: 875-6(Nov. 1962). (In English). (Translated by H. S. H. Massey from Iskusst. Sputniki Zemli, No. 10, p.96, 1961).

In the second Soviet space vehicle an emulsion stack containing 489 layers of BR emulsion 10 cm × 10 cm × 400 μ was placed. The stack was exposed outside the atmosphere at 300 km for approximately one day. After recovery and processing, 442 normal nuclei that had come to rest and 320 stars were found in a volume of 656 cm^3 of emulsion. It was found that none of the stars possessed properties peculiar to the annihilation of a multicharged antiparticle. (W.D.M.)

6916 PRE-STELLAR STATE OF MATTER. Ya. B. Zel'dovich (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1561-2(Oct. 1962). (In Russian)

It is postulated that in the initial stage of evaluation matter consisted of an equal mixture of protons, electrons, and neutrino with small entropies. At high (about nuclear) density and zero temperature neutrino and electrons formed a degenerate relativistic Fermi gas with Fermi-energy ($E_{F\nu}$) higher than the electron Fermi energy due to the spirality (two-component) neutrino, the density 2.5×10^{38} particle/cm^3, and the $E_{F\nu} = 500$ Mev and $E_{Fe} = 400$ Mev. An $e + p = n + \nu$ process producing neutrons at high substance density is forbidden by the neutrino state. In a homogeneous model (closed or open) neutrino never leave, and an expansion transforms the substance into pure cold hydrogen. According to the present concept, pure hydrogen was an initial substance in initial stars while heavier elements were produced by processes in the stars. (R.V.J.)

Cosmic Radiation

6917 (UCRL-6792-T) THE ELECTRON SPECTRUM FROM 80 TO 1258 kev OBSERVED ON DISCOVERER SATELLITES 29 AND 31. L. G. Mann, S. D. Bloom, and H. I. West, Jr. (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 15, 1962. Contract W-7405-eng-48. 4p.

The electron spectrum was measured in nearly polar orbits on Discoverers 29 and 31. Low-energy spectra were time dependent and observed principally in the northern hemisphere at altitudes of 160 to 200 km. Intermediate-energy spectra were observed mainly in the southern auroral zone at an altitude of the order of 560 km. The data for this spectra were observed as groups of jets or sharp rises in counting rate. The high-energy spectra were observed in the region of the South American dipolar anomaly at an altitude of ~500 km. Data indicated that this phenomenon must be mainly due to the intersection with the earth's atmosphere of the inner Van Allen Radiation Belt. (M.C.G.)

6918 SEA-LEVEL MOMENTUM SPECTRA OF MUONS. D. W. Coates (Monash Univ., Melbourne) and W. F. Nash. Australian J. Phys., 15: 420-31(Sept. 1962).

The sea-level muon momentum spectrum at 0.7 to 30 Bev/c is measured at Nottingham, England, at zenith angles of 0, 30, and 45°W, based on 1052, 1010, and 1033 particles respectively. Within the statistical accuracy of the experiment, agreement is found with theories based on either single-level or extended production of the muons. (auth)

6919 DESCRIPTION OF A COSMIC RAY JET IN TERMS OF THE TWO-CENTRE MODEL. K. Lanius (Inst. of Nuclear Physics, German Academy of Science, Berlin), H. Meier, J. Pernegr, and M. Suk. Czech. J. Phys., 12: 738-41(1962). (In English)

A cosmic ray jet with primary energy about 10^{13} ev, along with its secondary interactions, are investigated in order to compare predictions of alternative variants of the two-center model of particle emission. (auth)

6920 SOLAR PROTONS AND MAGNETIC STORMS IN JULY 1961. G. F. Pieper (Johns Hopkins Univ., Silver Spring, Md.), A. J. Zmuda, C. O. Bostrom, and B. J. O'Brien. J. Geophys. Res., 67: 4959-81(Dec. 1962).

The State University of Iowa's satellite Injun 1 (1961_{O_2}) was launched at 0422 UT on June 29, 1961, and is in an orbit of 67° inclination with apogee 998 km and perigee 881 km. Among the Injun instruments are silicon p-n junction detectors sensitive to protons with energy between 1 and 15 Mev, and a Geiger counter sensitive to protons of energy above 40 Mev. These units detected solar protons during the period of considerable solar activity extending from July 11 to 28, an epoch containing twelve flares of class 2 or 3 and six major magnetic storms that can be divided into four distinct solar proton events. In this period the proton intensity varied widely, with a maximum unidirectional flux of 33,000 particles/cm^2 sec ster for 1- to 15-Mev protons occurring during the storm of 1115 UT, July 13, and a maximum omnidirectional flux of 900 particles/cm^2 sec for protons of energy above 40 Mev in the storm of 1121 UT July 18. In general, the energy spectrum varied from storm to storm and within a single storm. The temporal and spatial characteristics of the solar proton flux are correlated with details of geomagnetic storms and other solar-terrestrial phenomena such as polar-cap

absorption. Some 1- to 15-Mev protons leak out of the main solar stream and enter the geomagnetic field many hours before the onset of a magnetic storm. These particles are observed only on magnetic shells of L with values between 4.8 and 6.1 earth radii, the range corresponding to the undisturbed geomagnetic cutoffs. A large influx of 1- to 15-Mev protons occurs during the last part of the initial phase of the storm and during the early part of the main phase, indicating their previous containment in the storm-producing plasma. A marked equatorial shift of the cutoff latitude occurs during the main phase of the storm. A sharp decrease in the flux in the main phase is followed by a slower exponential decay with a relaxation time of about one day for the 1- to 15-Mev particles. This decay begins after the peak of the main phase and extends through the recovery period of the storm, during which the geomagnetic cutoff gradually returns to its prestorm value. The possibility that the 1- to 15-Mev particles are geomagnetically trapped during the exponential decay is discussed. Considerable fluxes of protons with energy above 40 Mev were observed during only one of the four solar proton events reported. The storm-time cutoffs of these protons occurred at L values lower than the corresponding cutoffs observed with the 1- to 15-Mev protons. These observations and those reported for similar events by other workers are compared in detail. An over-all picture for such events is proposed. (auth)

6921 EXPLORER 12 OBSERVATIONS OF SOLAR COSMIC RAYS AND ENERGETIC STORM PARTICLES AFTER THE SOLAR FLARE OF SEPTEMBER 28, 1961. D. A. Bryant, T. L. Cline, U. D. Desai, and F. B. McDonald (Goddard Space Flight Center, Greenbelt, Md.). J. Geophys. Res., 67: 4983-5000(Dec. 1962).

A full description of the cosmic ray experiment on Explorer 12 is given and cosmic ray measurements made during the solar event of September 28, 1961, are reported and discussed. Galactic cosmic ray measurements are also reported. A few hours before the class 3 flare of September 28, two short counting rate increases were observed and are interpreted as electron bursts. The anisotropy of the medium- and low-energy solar protons early in the event and their intensity throughout the event are described. It is found that the history of the intensity of the solar protons is consistent, once isotropy is established, with their having diffused through interplanetary space with an effective mean free path of 0.04 AU. This result is discussed and is shown to be not obviously in disagreement with the generally accepted views regarding the configuration of the interplanetary magnetic field. An estimate of the distance from the sun at which diffusion becomes unimportant and particles escape gives 2 to 3 AU. It is pointed out that simple diffusion (where the particles are scattered from discrete scattering centers and the influence of a general magnetic field is negligible) does not account for the behavior of the anisotropy before isotropy is reached. Two days after the flare, and beginning just before the sudden commencement of a magnetic storm, there was a large increase in the intensity of protons between 2 and 15 Mev, the lower energy limit being determined by the sensitivity of the detectors. As most of these particles, which we have called 'energetic storm particles,' arrived after the sudden commencement occurred, we suggest that they were solar protons trapped within the plasma cloud which caused the magnetic storm. The outline of a possible trapping mechanism is given. Explorer 12 measurements of the Forbush decrease of September 30, 1961, are compared with neutron monitor measurements at Deep River. The decrease is larger at Explorer 12 by a factor of 1.7 ± 0.3. (auth)

6922 PROTONS OF 0.1 TO 5 Mev AND ELECTRONS OF 20 kev AT 12 EARTH RADII DURING SUDDEN COMMENCEMENT ON SEPTEMBER 30, 1961. R. A. Hoffman, L. R. Davis, and J. M. Williamson (Goddard Space Flight Center, Greenbelt, Md.). J. Geophys. Res., 67: 5001-5 (Dec. 1962).

During the period around the sudden commencement of the September 30, 1961, magnetic storm, the ion-electron detector aboard Explorer 12 observed fluxes of low-energy protons and electrons while the satellite was at 12 earth radii and free of the magnetosphere. Whereas the proton intensities initiated an increase about 25 minutes before the sudden commencement, a sudden jump in the omnidirectional intensity occurred eight minutes before the sudden commencement. The maximum flux of about 2×10^5 protons/cm^2 sec ster above 140 kev was attained a half hour after the sudden commencement. Thereafter the intensities varied irregularly with time and displayed fluctuations in anisotropy over the look cone of the detector that were dependent upon the direction of the local magnetic field. The energy spectrum was independent of both time and intensity. The energy density of the proton spectrum (1×10^{-9} erg/cm^3) was too small to account for the observed compression of the earth's field on the sunlit side during the magnetic storm. Time coincident with the sudden jump in proton intensities, an electron flux first appeared and reached its peak value of 3×10^6 electrons/cm^2 sec ster in the 10- to 35-kev range about one minute before the observance of the sudden commencement on the earth's surface. It continued for about 10 minutes and then disappeared. The detection efficiency for electrons places an upper limit of 2×10^5 electrons/cm^2 sec ster for the rest of the storm. (auth)

6923 PRELIMINARY EXPLORER 12 DATA ON PROTONS BELOW 20 kev. Michel Bader (Ames Research Center, Moffett Field, Calif.). J. Geophys. Res., 67: 5007-11(Dec. 1962).

An attempt was made by means of Explorer 12 to obtain the energy spectrum of protons along the trajectory in the energy range 100 ev to 20 kev. The data for the period September 27 through October 4, 1961, were examined in some detail because of the concurrent solar and geomagnetic activities. The proton fluxes in the directions sampled were generally below the threshold of detectability of the instrument. This is an extremely significant result in view of the fact that the magnetometer records clearly demonstrate that the apogee of the satellite was beyond the normal, compressed geomagnetic field. It is concluded that neither a proton ring current nor a sharp Chapman-Ferraro boundary was present, but that a broad, diffuse transition region existed between the geomagnetic field termination and the interplanetary medium. (auth)

6924 DIFFUSION OF ELECTRONS IN THE VAN ALLEN RADIATION BELT. 1. TREATMENT OF PARTICLES WITH MIRRORING POINTS AT HIGH ALTITUDE. Martin Walt (Lockheed Missiles and Space Co., Palo Alto, Calif.) and William M. MacDonald. J. Geophys. Res., 67: 5013-24(Dec. 1962).

The Fokker-Planck equation describing the distribution of electrons in the Van Allen radiation belt under the influence of atmosphere scattering is solved, and the resulting expressions are evaluated to demonstrate the energy loss and pitch-angle diffusion of electrons initially trapped high in the geomagnetic field. From these calculations it is concluded that (a) energy loss and diffusive leakage oc-

cur at comparable rates and both effects must be included, (b) the initial pitch-angle distributions are severely altered by scattering so that it is extremely difficult to derive the angular or spatial distribution of the source from the equilibrium pitch-angle distribution, and (c) the computed time for 1.0-Mev electrons to be lost by leakage or energy loss is on the order of tens of years. (auth)

6925 DIFFUSION OF ELECTRONS IN THE VAN ALLEN RADIATION BELT. 2. PARTICLES WITH MIRRORING POINTS AT LOW ALTITUDE. William M. MacDonald (Univ. of Maryland, College Park and Lockheed Missiles and Space Co., Palo Alto, Calif.) and Martin Walt. J. Geophys. Res., 67: 5025-33(Dec. 1962).

Using the Fokker-Planck approach a diffusion equation is derived for the distribution of the mirror points of geomagnetically trapped electrons for an exponential atmosphere, and an analytic solution is obtained. From the nature of the equation it is seen that the mirror points diffuse in a manner similar to heat flow in a nonuniform medium, the net flux being determined by the gradients in the distribution function. The concept of lowering mirror points, which has been extensively used for this type of calculation, is shown to be incorrect. The distribution of mirror points is found for the case of an initial distribution that is a delta function in mirror-point altitude by evaluating the analytic solution to the equation for an exponential atmosphere. The result is compared with that obtained by a numerical integration of the diffusion equation, derived in an earlier paper, which is not restricted to the case of an exponential atmosphere. Diffusion in the region of magnetic anomalies is discussed. (auth)

6926 OBSERVATIONS OF LOW-FREQUENCY HYDROMAGNETIC WAVES IN THE DISTANT GEOMAGNETIC FIELD: EXPLORER 6. Darrell L. Judge (Space Tech. Labs., Redondo Beach, Calif.) and Paul J. Coleman, Jr. J. Geophys. Res., 67: 5071-90(Dec. 1962).

Certain of the measurements obtained simultaneously with three of the instruments aboard the earth satellite Explorer 6 are discussed. The results from these instruments the magnetometer, aspect indicator, and scintillation detector, provide direct evidence for the existence of low-frequency hydromagnetic fluctuations in the distant geomagnetic field, as well as some information pertaining to their specific characteristics. The observed phenomena consist of variations in the amplitude and direction of the measured component of the magnetic field accompanied by substantial changes in the intensity of the energetic particles detected by the scintillation counter. The fluctuations exhibited periods between 100 and 500 seconds. Within this range of periods, variations of the order of 10 γ ($\Delta B/B \simeq 0.15$) in amplitude and 15° in orientation were observed in the measured component of the field. These field changes were accompanied by fluctuations of about the same relative amplitudes ($\Delta I/I \simeq 0.15$) in the intensity of the detected particles. Of particular interest is an observation of damped, quasi-sinusoidal oscillations detected simultaneously by all three instruments. As a basis for the interpretation of these results, simple models for hydromagnetic disturbances propagating in the transverse, or Alfvén, mode and in the compressional mode are described. Consequences of the existence of these hydromagnetic disturbances are discussed, particularly with regard to their possible effects upon the dynamics of the outer radiation belt. (auth)

6927 THE PRODUCTION OF FREE ELECTRONS IN THE IONOSPHERIC D LAYER BY SOLAR AND GALACTIC COSMIC RAYS AND THE RESULTANT ABSORPTION OF RADIO WAVES. William Webber (Univ. of Minnesota, Minneapolis). J. Geophys. Res., 67: 5091-5106(Dec. 1962).

The behavior of the D layer under bombardment by solar and galactic cosmic rays of energy greater than a few Mev is discussed. In particular, the variation with incident particle flux of the ionospheric parameters that determine the equilibrium electron density is deduced by means of the measurements of mid-day and mid-night absorption of cosmic radio noise corresponding to identical fluxes and spectrums of solar cosmic rays (protons). The values of the ionospheric parameters so obtained are then used, in conjunction with differential solar proton spectrums of the form $dJ/dP = Ke^{-P/P_0}$ to determine the electron densities and resultant absorption effects of cosmic radio noise in the range 3-30 Mc/s. Special attention is given to weak absorption effects in the ranges 3-10 Mc/s and to problems relating to the measurement of small, low-energy solar-particle events and to the changes in the low-energy portion of the spectrum of galactic cosmic rays. (auth)

6928 SUDDEN INCREASE OF RADIATION INTENSITY COINCIDING WITH A GEOMAGNETIC STORM SUDDEN COMMENCEMENT. E. Keppler (Max-Planck-Institut fur Aeronomie, Lindau, Ger.), A. Ehmert, G. Pfotzer, and J. Ortner. J. Geophys. Res., 67: 5343-6(Dec. 1962).

A sudden increase of radiation in the auroral zone coinciding with the sudden commencement on July 13, 1961, at 1113 UT was measured at balloon altitudes. The sc was probably caused by a solar flare of importance 3 that occurred on July 11. After a second class 3^+ flare, which started on July 12 at 1000 UT, a plastic balloon carrying a counter telescope, a single GM counter, and an ionization chamber. (W.D.M.)

6929 COMPARISON OF FORBUSH DECREASE MEASUREMENTS MADE AT BALLOON ALTITUDE AND GROUND ELEVATION. W. R. Webber (Univ. of Minnesota, Minneapolis) and J. A. Lockwood. J. Geophys. Res., 67: 5347-9(Dec. 1962).

On June 27, 1960, at 2230 UT a rapid Forbush decrease of about 8% in magnitude was recorded by the cosmic-ray neutron monitor at Mt. Washington. Simultaneously a standard ion chamber and Geiger counter designed at the University of Minnesota was at balloon altitudes over Minneapolis. Intensities recorded by the detectors are shown. Insight into the modulation mechanism can be obtained by a detailed comparison of the decreases recorded by the ion chamber and counter and the neutron monitor. (W.D.M.)

6930 COMMENTS ON A PAPER BY HESS AND POIRIER. M. Walt (Lockheed Missiles and Space Co., Palo Alto, Calif.) and William M. MacDonald. J. Geophys. Res., 67: 5350-1(Dec. 1962).

In a recent paper Hess and Poirer (J. Geophys. Research, 67, 1699, 1962.) calculated the flux and energy spectrum of geomagnetically trapped electrons produced by thermal neutron decay. Some of their estimates regarding the physical processes of the diffusion of electrons in the radiation belts are not in agreement with those of other authors. Since these differences are of importance in problems other than neutron decay, it is desirable to clarify the causes of these discrepancies. (W.D.M.)

6931 GEOMAGNETIC EFFECTS OF HEAVY PRIMARY OF COSMIC RADIATION AT GEOMAGNETIC LATITUDE 24°N. Morio Miyagaki (Kobe Univ., Japan). J. Phys. Soc. Japan, 17: 1824-35(Dec. 1962). (In English)

The azimuthal distribution of heavy nuclei in primary cosmic radiation is measured by means of an orientation-

controlled nuclear emulsion stack exposed at geomagnetic latitude 24°N. Assuming that the integral energy spectrum of heavy primaries is represented by $N(\geq E) = K(1 + E)^{-\gamma}$. The exponent γ obtained from the azimuthal distribution is comparable to that found from geomagnetic cut-off theory. The obtained value of γ is 1.26 ± 0.35. This value may be affected by the solar activity. (auth)

6932 DETECTION OF COSMIC RAY μ-MESONS BY THE HUMAN EYE. F. J. D'Arcy and N. A. Porter (University Coll., Dublin). Nature, 196: 1013-14(Dec. 8, 1962).

The detection of cosmic ray μ mesons by the human eye was investigated in human subjects. The observer lay on a couch in a dark room with a small Geiger telescope attached to a pair of darkened glasses worn on the head so that cosmic ray μ-mesons passing through the right eye were recorded. The telescope operated a mechanical register, which was audible to an observer, and a scaler. Mesons were counted at a rate of approximately 1/min. A larger Geiger telescope, placed some distance away, operated at about 5/c min and was connected to the same mechanical register but to a different scaler. Thus identical audible signals were given to the observer at random intervals and only 20% of those corresponded to the passage of a genuine μ-meson through the eye. The scaler readings were recorded by an operator in communication with the observer. Observers described the visual sensation associated with the genuine signal as a bright point of light rather than the diffuse disk expected. Analysis of results using 9 observers indicate that the signal observed may be due to detection through a direct excitation of the retina rather than due to the emission of Cherenkov radiation in the vitreous humour. The energy deposited by ionization in transversing a rod or cone was determined to be about 500 ev. (C.H.)

6933 DECAY OF AN ARBITRARY PLANE-STRATIFIED DISTRIBUTION OF IONIZATION ASSUMED TO BE PRODUCED INSTANTANEOUSLY IN THE F2 REGION. J. E. C. Gliddon (Univ. of London). Planetary Space Sci., 9: 815-26(Nov. 1962). (In English)

An initial distribution of ionization, plane stratified and varying with altitude in an arbitrary manner, is assumed to be produced instantaneously under ambient conditions similar to those existing in the F2 region. It is shown that after a sufficiently long time the electron density develops a maximum. The behavior of the height of maximum electron density and of times of decay are examined. Special cases considered are (i) decay of ionization produced by an intense pulse of solar radiation; (ii) decay of a thin concentrated layer of ionization. (auth)

6934 THE POSITION OF THE INNER RADIATION BELT AND THE EARTH'S MAGNETIC FIELD. Ye. V. Gorchakov. Planetary Space Sci., 9: 841-4(Nov. 1962). (In English). (Translated by J. Cornish from Iskusst. Sputniki Zemli, No. 9, p.62, 1961).

The scintillation counter installed in the third earth satellite measured the ionization in a NaI crystal and counted the number of events over 35 kev. With the aid of a memory device the counting rate could be determined unambiguously when the intensity did not exceed 436 pulses/sec. The boundary of the inner belt was determined when the intensity climbed above 436 pulses/sec. (W.D.M.)

6935 INVESTIGATION OF CHARGED PARTICLE INTENSITY DURING THE FLIGHTS OF THE SECOND AND THIRD SPACE-SHIPS. V. L. Ginzburg, L. V. Kurnosova, V. I. Logachev, L. A. Rozarenov, I. A. Sirotkin, and M. I. Fradkin. Planetary Space Sci., 9: 845-54(Nov. 1962). (In English). (Translated by R. Matthews from Iskusst. Sputniki Zemli, No. 10, p.22, 1961).

During the flight of the second and third earth satellites records of the charged particle flux at altitudes from 187 to 339 km and latitudes from –65 to +65° were obtained. A counter telescope, which consisted of two sets of gas discharge counters, was used as the recording instrument. The resolving time of the double coincidence circuit was 2×10^{-6} sec. (W.D.M.)

6936 THE OUTER RADIATION BELT OF THE EARTH AT THE ALTITUDE OF 320 KM. S. N. Vernov, I. A. Savenko, P. I. Shavrin, V. Ye. Nesterov, and N. F. Pisarenko. Planetary Space Sci., 9: 855-9(Nov. 1962). (Translated by O. M. Blunn from Iskusst. Sputniki Zemli, No. 10, p.34, 1961).

Scintillation and gas-discharge counters on the second Soviet spaceship allowed a detailed investigation of the outer radiation belt near the earth and established its boundaries in relation to longitude. The spaceship orbit was almost circular at an altitude of 306 to 339 km. The energy threshold of the counter channel was 25 kev. (W.D.M.)

6937 DETECTION OF AN INNER RADIATION BELT AT THE ALTITUDE OF 320 KM IN THE REGION OF THE SOUTH ATLANTIC MAGNETIC ANOMALY. S. I. Vernov, I. A. Savenko, P. I. Shavrin, and N. F. Pisarenko. Planetary Space Sci., 9: 861-5(Nov. 1962). (In English). (Translated by O. M. Blunn from Iskusst. Sputniki Zemli, No. 10, p.40, 1961).

The presence of large magnetic anomalies on the surface of the earth can significantly affect the position of the radiation belt. The anomalously low absolute value of magnetic field strength in the South Atlantic is discussed and data taken from the second Soviet space ship are shown. (W.D.M.)

6938 THE COSMIC RAY EQUATOR FROM DATA OF THE SECOND SOVIET EARTH SATELLITE. I. A. Savenko, P. I. Shavrin, V. Ye. Nesterov, and N. F. Pisarenko. Planetary Space Sci., 9: 867-8(Nov. 1962). (In English). (Translated by R. E. Daisley from Iskusst. Sputniki Zemli, No. 10, p.45, 1961).

Determination of the geographical position of the line of minimum intensity of primary cosmic radiation (cosmic ray equator) makes is possible to study the structure of the geomagnetic field and to check theoretical and empirical approximations to this field. The minima of cosmic radiation intensity were determined by the second Soviet spaceship for 22 latitude curves obtained from various crossings in the region of the geographical equator. (W.D.M.)

6939 ELECTRONIC COMPONENTS IN GALACTIC COSMIC RAYS. Satio Hayakawa and Haruyuki Okuda (Nagoya Univ., Japan). Prog. Theoret. Phys. (Kyoto), 28: 517-28(Sept. 1962).

The intensity and the energy spectrum of cosmic electrons arising from the nuclear collisions of cosmic rays are calculated by reference to experimental data obtained with accelerators and cosmic rays. The electron spectrum thus obtained agrees reasonably well with recent observations of electrons with energies below 1 Bev. The Galactic radio spectrum expected from the electrons is calculated with particular attention to its low frequency part. The less steep spectrum recently obtained may suggest considerable fluctuations in magnetic field strength in the galaxy. The γ-ray spectrum is also given of the same origin as the electrons. It is emphasized that the comparison of these three as well as the relative intensities of positons and negatons will be very important for the origin of cosmic rays and related astrophysical problems. (auth)

6940 THE ORIGIN OF COSMIC MUONS AND PHOTONS OF HIGH ENERGY AND THE HYPERON HYPOTHE-

SIS. Yu. D. Kotov and I. L. Rozental (Moscow Inst. of Engineering Physics). Zh. Eksperim. i Teor. Fiz., 43: 1141-18(Oct. 1962). (In Russian)

The differential spectrum of cosmic muons of energy 10^{11} to 10^{14} ev is calculated on the assumption that the particle carrying away most of the energy (0.7 to 0.8) of the primary is a hyperon. The spectrum obtained is in good agreement with experimental data. However, the calculated negative excess contradicts experimental data at an energy of ~100 Bev. It is shown that this discrepancy can be eliminated on the assumption that the distribution of generated hyperons by charge sign is due to statistical weight in isotopic space. Also calculated is the differential spectrum of γ quanta of energy 10^{11} to 10^{14} ev at great height. (auth)

6941 DIFFUSION OF ELECTRONS IN THE VAN ALLEN BELT. Martin Walt and William M. MacDonald (Lockheed Missiles and Space Co., Sunnyvale, Calif.). Preprint 2614-62. New York, American Rocket Society, 1962. 14p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

The electrons in the Van Allen belt are trapped in the geomagnetic field; the motion of their guiding centers can be characterized as a rapid north-south oscillation along magnetic lines of force, along with a less rapid eastward drift. With the assumption that the geomagnetic field is static and that the magnetic moment of the electron is constant between collisions, the diffusion equation describing the behavior of trapped electrons in the presence of a scattering atmosphere is derived by means of a Fokker-Planck approach. For electrons mirroring at altitudes above about 2,000 km, the general diffusion equation is solved by an expansion of the distribution function in eigenfunctions of the diffusion operator. For electrons that mirror at low altitudes, the equation is solved analytically if energy loss is neglected and the scattering atmosphere is assumed to vary exponentially with altitude. From these results it is concluded that energy loss and leakage out of the trapping region are of comparable importance; diffusion processes alter the initial distribution, so that little information on source position can be obtained from the measured distributions; and the average lifetime of a 1-Mev electron in the static geomagnetic field is on the order of tens of years. (auth)

Criticality Studies

6942 (TID-15342) INTERACTION OF FISSIONABLE UNITS. Hugh K. Clark (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [Mar. 1962]. Contract AT(07-2)-1. 28p.

A simple technique is described for computing the interaction in groupings of fissionable units. The units may be slabs, cylinders, or spheres and may be surrounded by a reflector. The validity of the approximations employed is discussed. The technique is illustrated by applying it to the specific example of calculating the interaction in a reflected cubic array of eight spheres of U (93.5% U^{235}). Comparisons are made with experiment and with other methods of calculation. (auth)

Elementary Particles and Radiations

6943 (BNL-5517) RELATION BETWEEN BINDING ENERGY AND COUPLING CONSTANT. M. Nauenberg (Brookhaven National Lab., Upton, N. Y.). June 2, 1961. Contract [AT(30-2)-Gen-16]. 5p.

Aspects of the relation of zero effective range theory between the renormalized coupling constant or pole residue in a two-particle scattering amplitude and the binding energy of the intermediate single particle state considered as a bound state of the scattering particles are considered. It is emphasized that a small binding energy does not exclude the possibility of a large effective range. (J.R.D.)

6944 (BNL-5528) SOME ANALYTIC PROPERTIES OF A DECAY AMPLITUDE WITH FINAL STATE INTERACTIONS. THE SINGLE-LOOP FOUR-POINT DIAGRAMS IN $K \rightarrow 3\pi$ DECAY. G. Barton (Brookhaven National Lab., Upton, N. Y.) and C. Kacser (Princeton Univ., N. J. Palmer Physical Lab.). June 6, 1961. Contract [AT-30-2-GEN-16]. 25p.

The analytic properties of the simplest single loop Feynman diagrams whose contributions to $K \rightarrow 3\pi$ decay depend on both of the independent energy variables are investigated. This is done by replacing the two internal double pion lines by fictitious single lines of discrete rest masses, λ_1 and λ_2, and integrating over λ_1 and λ_2 at the end of the calculation. The analytic properties of the actual amplitude are those of the fictitious amplitude in the limit as λ_1 and λ_2 independently tend to a value of two pion masses from above. The amplitude has complex singularities and does not satisfy a Mandelstam-type representation. However, a one dimensional dispersion representation with only real cuts does hold in one variable when the other variable is fixed at any real value. Comment is included on the change in the properties of the amplitude as the K meson mass increases past the instability point. (auth)

6945 (BNL-5648) CONCERNING THE POLARIZATION OF PROTONS IN Pd–Ni ALLOY. R. Schermer and V. L. Sailor (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract [AT(30-2)-Gen-16]. 6p.

A single transmission effect for thermal neutrons due to hydrogen contained interstitially in a ferromagnetic Pd–Ni alloy at room temperature has been reported. This effect was explained on the basis of proton polarization. The experiment has been repeated in a more sensitive manner, by measuring the spin-dependent transmission of the sample for polarized neutrons. A proton polarization of $(2.5 \pm 5)\%$ was found and it is concluded that the previously reported effect is at least two orders of magnitude too large to be explained in this manner. (auth)

6946 (BNL-5726) THEORY OF THE QUANTIZATION OF BARYON NUMBER AND HYPERCHARGE. Paul C. DeCelles (Brookhaven National Lab., Upton, N. Y.). Oct. 16, 1961. Contract [AT-30-2-GEN-16]. 10p.

A discussion is presented in which an explanation concerning the quantization of baryon number and hypercharge (strangeness) in strong interactions is offered. A relation between the strengths of these interactions is derived. (J.R.D.)

6947 (IA-768) PROTONIUM TWO-MESON ANNIHILATION IN THE LIGHT OF UNITARY SYMMETRY. Y. Ne'eman and H. Goldberg (Israel. Atomic Energy Commission, Rehovoth). Aug. 1962. 10p.

Recently reported results about the annihilation of $\bar{p}\,p$ into two mesons, either $\Pi^- + \Pi^+$, $K^- + K^+$, or $\bar{K}^0 + K^0$, contradict the predictions of the Sakata model. However, these results could fit the octet version of unitary symmetry assuming the two mesons to emerge mainly from the decay of a virtual vector meson or from a pair with similar transformation properties. Predictions concerning the

annihilation of anti-baryon + proton or anti-baryon + neutron were made accordingly. R-symmetry seemed to play no role in strong interactions. (auth)

6948 (IS-429) αZ CORRECTION TO THE BETHE-MAXIMON PAIR PRODUCTION CROSS SECTION. David S. Moroi and C. L. Hammer (Ames Lab., Ames, Iowa). [Feb. 27, 1962]. Contract [W-7405-eng-82]. 13p.

The first order correction in αZ to the Bethe-Maximon pair production cross section is calculated for the case where the incident photon and one of the electrons has an energy much greater than mc. Comparison of these calculations with the experimental data of Plimpton and Hammer shows an improvement in agreement between theory and experiment of approximately a factor of $1 + (\alpha Z 4\pi/15)$ for low positron kinetic energies. However, for positron kinetic energies of the order of 1 Mev no improvement is obtained. (auth)

6949 (JINR-D-1073) ANGULAR DEPENDENCE OF THE POLARIZATION CORRELATION C_{nn} AND THE DETERMINATION OF THE SCATTERING AMPLITUDE MODULI FOR pp SCATTERING AT 640 Mev. II. THE ESTIMATION OF THE SINGLET PHASE SHIFTS. B. M. Golovin, V. P. Dzhelepov, R. Ja. Zul'karneev, and Wang-chuang Tzui (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 9p.

Experiments on triple proton-proton scattering are described, and measurements were made of the spin correlation coefficient C_{nn} in elastic proton-proton scattering at 640 Mev for some c.m.s. angles different from 90°. By analyzing the experimental data and those available in the literature for the given energy, the moduli of the p-p scattering amplitudes were determined quantitatively in the wide angle range $50° < \theta < 130°$. Their relative contributions were evaluated. The values of the singlet and triplet cross sections were determined for some angles; the phase shifts were estimated for a p-p system in the singlet states at 640 Mev. (auth)

6950 (JINR-E-1050) ON A POSSIBILITY OF DISCOVERING THE NEUTRAL CURRENTS IN NEUTRINO EXPERIMENTS. R. A. Eramjan, S. S. Gerstein, and Vanhieu Nguyen (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 3p.

The use of neutrino experiments to discover neutral currents in the weak interaction scheme is discussed. (M.C.G.)

6951 (JINR-P-1091) RASPROSTRANENIE SIGNALA VNUTRI ELEMENTARNOI CHASTITSY. (Propagation of a Signal Inside an Elementary Particle). D. I. Blokhintsev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 12p.

Signal propagation inside an elementary particle was studied, and it is shown that the ratio paradox of indefiniteness prevents the signals from propagating with velocities exceeding the velocity of light in a vacuum. (R.V.J.)

6952 (LNF-62/75) SPIN CORRELATION IN MUON PAIR PRODUCTION. Note No. 159. F. Erdas and G. v. Gehlen (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Sept. 7, 1962. 17p.

The correlation of the meson (μ) spins in meson (μ) pair production by unpolarized photons was calculated in the Born approximation. The longitudinal correlation coefficient was found to be sensitive to a cut-off in the meson (μ) propagator at 0.1 Fermi. (auth)

6953 (LNF-62/89) FORM FACTORS OF K_{e3} DECAY AND KAON PRODUCTION BY HIGH ENERGY NEUTRINOS. Note No. 163. A. Fujii and E. Celeghini (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Oct. 19, 1962. 12p.

The cross section for meson (K) production by high energy neutrinos, $\nu + p \rightarrow p + e^- + K$, was computed in the peripheral approximation. Numerical estimates were made with specific form factors derived from the dispersion theory. The cross section depends on such a dynamical model, hence it can serve as a criterion of the model. (auth)

6954 (NP-12259) MULTIPLE SCATTERING MEASUREMENTS IN THE PRESENCE OF ENERGY LOSSES. A. Marques (Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas). 1962. 32p. (Notas de Física Vol. IX, No. 17(p.325-53)).

A first-order correction to the estimation of true scattering that accounts for small energy losses is derived. Energy values obtained from scattering measurements performed on pions, starting at 8 mm and 12 mm residual range, show excellent agreement with values taken from range-energy tables when the original observations are treated according to the prescriptions developed throughout. (auth)

6955 (RM-3399-PR) COMPARISON OF MONTE CARLO CALCULATIONS WITH EXPERIMENTAL RESULTS FOR THE PROPAGATION OF GAMMA RAYS NEAR AN AIR-GROUND INTERFACE. J. I. Marcum (RAND Corp., Santa Monica, Calif.). Dec. 1962. Contract AF 49(638)-700. 23p.

The RAND gamma ray Monte Carlo code is used to predict dosages from point isotropic monoenergetic sources of 1.28 Mev and 0.661 Mev near an air-ground interface. These results are compared with experimental results for identical geometry obtained by the Nuclear Defense Laboratory. In general the agreement between the Monte Carlo estimates and the experimental results is quite good. (auth)

6956 (TID-13705) ROTATIONAL MOTION IN A MANY PARTICLE SYSTEM. PART I. GENERAL THEORY. PART II. INTRINSIC EXCITATION OF EVEN-EVEN NUCLEI. Tatuya Sasakawa (Massachusetts Inst. of Tech., Cambridge and Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). [Sept. 13, 1961]. Contract AT(30-1)-2098. 113p.

On the basis of quantum mechanics it is shown that in an N-particle system the whole motion can be divided into three parts: the center-of-mass motion, the rigid motion as a whole, and the intrinsic translational motion. The resulting formulas are similar to those in classical mechanics. Intrinsic excitations of the rotational levels of even-even nuclei and the intrinsic structure of the wave functions were investigated without using the Hamiltonian of the Bohr model. The rotational levels of negative parity were treated on the same basis as the levels of positive parity. The importance of the Coriolis interaction is stressed in connection with the M1 transition. The method of analyzing the experimental data without using any model was developed. Examples are given for several nuclei. (auth)

6957 (TID-17357(Pt.I)) SCATTERING STUDIES WITH THE OHIO STATE UNIVERSITY CYCLOTRON. Report 735 (Final). Part I. Period covered: January 1, 1957–September 30, 1962. H. J. Hausman (Ohio State Univ. Research Foundation, Columbus). Nov. 1962. Contract AT(11-1)-503. 32p.

The primary research effort during the first three years of contract support was devoted to investigations of nuclear reaction mechanisms. Attempts were made to detect the presence of direct-reaction processes at proton bombarding energies of 6.75 Mev. The experiments involved the measurement of angular distributions of inelastically scat-

tered protons from light and medium-weight elements. Results of these experiments were difficult to interpret and the decision was made to extend the investigations to include the angular correlations between inelastically scattered protons and the decay gamma radiation from the excited state. Results of angular correlation measurements from several reactions are given along with results obtained in investigations of proton-induced absolute reaction cross sections, He^3-induced reactions, the He^3 accelerator parameters, and He^3 scattering. (J.R.D.)

6958 (UCRL-7091) LIFETIMES OF EXCITED NUCLEAR STATES USING DELAYED REACTION GAMMA RAYS. R. W. Bauer, J. D. Anderson, and L. J. Christensen (California. Univ., Livermore. Lawrence Radiation Lab.). Oct. 29, 1962. Contract W-7405-eng-48. 26p.

Using the pulsed charged-particle beam from the Livermore variable-energy cyclotron, the delayed reaction gamma rays were employed for a direct measurement of lifetime of excited nuclear states in the nanosecond region. This technique is particularly useful in the investigation of states not populated (or only weakly populated) by radioactive decay. The mean lives of excited states of several nuclei in the $f_{\frac{7}{2}}$ shell were measured. Using the $Ti^{48}(p,n\gamma)$ and $Sc^{48}(\alpha,n\gamma)$ reactions the 305-kev state of V^{48} yields (10.9 ± 0.4) nsec. Using the $V^{51}(p,n\gamma)$ and $Ti^{48}(\alpha,n\gamma)$ reactions the 750-kev state of Cr^{51} yields (10.8 ± 0.5) nsec. Considering previously reported level spin and gamma-ray multipolarity assignments, these lifetimes appear to be anomalously long, indicating an extremely high degree of retardation of these electromagnetic transitions within the $f_{\frac{7}{2}}$ neutron and proton shells. These measurements were confirmed using the delayed gamma-gamma coincidences following the radioactive decays of Cr^{48} and Mn^{51}, respectively. (auth)

6959 (UCRL-9288(Rev.)) ANTIPROTON-NUCLEON CROSS SECTIONS FROM 0.5 TO 1.0 Bev. Tommy Elioff, Louis Agnew, Owen Chamberlain, Herbert M. Steiner, Clyde Wiegand, and Tom Ypsilantis (California. Univ., Berkeley. Lawrence Radiation Lab.). Dec. 12, 1961. Contract W-7405-eng-48. 68p.

Antiproton-production and nucleon-interaction cross sections were investigated for antiprotons in the energy range 0.5 to 1.0 Bev. The antiprotons were distinguished from other particles produced at the Bevatron by a system of scintillation- and velocity-selecting Cherenkov counters. The excitation function and momentum distribution were recorded for antiproton production in carbon and compared with statistical model expectations. The antiprotons were directed by a system of bending and focusing magnets to a liquid hydrogen target. An array of plastic scintillation counters, which almost completely surrounded the hydrogen target, was used to determine the $\bar{p}$-p total, elastic, inelastic, and charge-exchange cross sections. Near 500 Mev the total $\bar{p}$-p cross section was about 120 mb, and it slowly decreased to 100 mb near 1 Bev. The inelastic cross section, which is principally due to the annihilation process, represented nearly $\frac{2}{3}$ of the total cross section. The elastic scattering distribution was highly peaked in the forward direction and could be fitted by an optical model. The total and partial cross sections were also determined for the collisions of antiprotons with deuterons. The $\bar{p}$-d total and inelastic cross sections were found to be approximately 1.8 times the $\bar{p}$-p cross sections. Corrections were made for the shielding of nucleons within the deuteron in order to ascertain the $\bar{p}$-n interaction. The results indicate that the $\bar{p}$-p and $\bar{p}$-n cross sections are very nearly equal in this energy region, and that they satisfy the inequalities required by charge independence. (auth)

6960 (UCRL-9793) SEMIEMPIRICAL CORRELATION OF β^+ ANNIHILATION RATES IN METALS. James A. McHugh (California. Univ., Berkeley. Lawrence Radiation Lab.). July 1961. Contract W-7405-eng-48. 7p.

It is shown that the annihilations rates of positrons in metals can be correlated to a good degree by a simple model of the annihilation process based on an assumption that the fractional number of electrons available for annihilation varies as the inverse of the atomic volume of the metal. (auth)

6961 (UCRL-9889) ELECTROMAGNETIC PROPERTIES OF A CHARGED VECTOR MESON. James A. Young and A. Bludmen (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 12, 1961. Contract W-7405-eng-48. 32p.

A systematic study was made of the electromagnetic properties of charged vector mesons. The various formalisms used to describe charged particles of spin 1 were compared, and a first-order formulation of the Stuckelberg theory was developed. For the most general first-order Proca Lagrangian, subject to the usual symmetry requirements the redundant components were eliminated to obtain a Hamiltonian formulation. The theory was interpreted in the nonrelativistic limit, and the terms corresponding to spin-orbit coupling and electric quadrupole-moment interaction were identified. The analogy to spin $\frac{1}{2}$ theory led to the consideration of classical spin equations of motion which agree with the quantum mechanical equations to order m^{-2}. This general form for the electromagnetic interaction was applied to a recalculation of the $\mu \rightarrow e + \gamma$ decay rate through a vector meson intermediary. It was concluded that the absence of this process is not necessarily an argument against the existence of an intermediary meson in weak interactions. (auth)

6962 (AEC-tr-5226) THEORY OF WEAK INTERACTIONS: THIRTEEN LECTURES. L. B. Okun. Translation of "Lektsii po Slabym Vzaimodeistviyam" (a publication of the Institute of Theoretical and Experimental Physics, Academy of Sciences, Moscow, 1960). 199p.

The main conservation laws, selection rules, and symmetry rules in the theory of weak interactions of elementary particles are discussed. Topics covered include: interactions and currents, muon decay, structure of weak interactions, charge conjugation, inversion of coordinates, time reversals, lepton decays of strongly interacting particles, lepton decays that conserve strangeness, properties of vector current, isotopic parity in lepton decays of strongly interacting particles, lepton decays with conservation of strangeness, lepton decays of strange particles with change of strangeness, and non-lepton decays of strange particles. (M.C.G.)

6963 UNIFIED HAMILTONIAN THEORY OF RELATIVISTIC PARTICLE EQUATIONS. Eugene Guth (Oak Ridge National Lab., Tenn.). Ann. Phys. (N. Y.), 20: 309-35(Dec. 1962).

A unified equation is derived for the Zitterbewegung of the space coordinate. The Spinbewegung and the spin-dependent aspects of the Zitterbewegung are investigated and compared. The explicit structure of the "linear" Hamiltonian is developed. The interdependence of the equations of the motion and of the commutation relations is discussed. Particles of spin 0, $\frac{1}{2}$, and 1 are considered separately. The development is based on a Heisenberg-type formalism.

6964 ON THE ANOMALOUS THRESHOLD OF THE DEUTERON VERTEX FUNCTION. Bengt Enflo (Univ. of Stockholm). Arkiv Fysik, 22: 543-8(1962).

The prescription for handling the anomalous threshold of the deuteron vertex function Γ is established, using the theory of functions defined by integrals. By this method it is possible to show that the dispersion integral for Γ has the same anomalous term, if the dispersion relation is an integral equation for Γ or if it permits a direct evaluation of Γ. (auth)

6965 ON THE NAKANISHI PARAMETRIC REPRESENTATION. W. Garczyński (Univ. of Wrocław, Poland). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 10: 457-62(1962). (In English)

A general parametric representation of any term of the perturbation expansion of a scattering amplitude is presented and shown to be equivalent to that of Nakanishi (Progr. Theoret. Phys. (Kyoto) 17, 401(1957) and Suppl. Progr. Theoret. Phys. 18, 1(1961)). (T.F.H.)

6966 MEASUREMENTS OF THE CROSS SECTION OF INELASTIC CHARGE EXCHANGE OF K^+ MESONS IN HYDROGEN AT 1.12 AND 1.45 Gev/C. David Berley, Elihu Boldt, Jean Crussard, Jean Duboc, Philippe Eberhard, Roger George, Victor Henri, Françoise Lévy, and Jacques Poyen (College de France, Paris and Centre d'Études Nucléaires, Saclay, France). Compt. Rend., 255: 890-2 (July 30, 1962). (In French)

The cross section for the inelastic charge exchange corresponding to the reaction $K^+ + P \rightarrow K^0 + P + \pi^+$ was measured for K^+ mesons with average momenta of 1.12 and 1.45 Bev/c. The values obtained were 4.2 ± 0.4 mb for 1.12 Bev/c, all corrections made, and 5.4 ± 0.6 mb for 1.45 Bev/c. (tr-auth)

6967 NEW ISOBARIC SCHEME FOR ELEMENTARY PARTICLES. R. Zaikov. Compt. Rend. Acad. Bulgare Sci., 15: 353-6(1962). (In English)

By using six isobaric quantum values, a new scheme of elementary particles was drawn up which differs from those employed hitherto. Two different k mesons were used in the new scheme. Rules were established for the selection of quantum values, on the basis of which strong and weak electromagnetic interactions result. The new scheme covers all observed reactions and forbids all reactions which have not been observed. It excludes the existence of super-heavy baryons and mesons, which have actually not been observed. It is shown that if a ρ^0 meson with a vanishing isobaric spin exists, its strong interaction must vanish identically. (OTS)

6968 A REMARK ON THE DECAY RATE OF BOUND MUONS. A. Vančura (Faculty of Technical and Nuclear Physics, Prague). Czech. J. Phys., 12: 649-52(1962). (In English)

The probability of the decay of a bound μ-meson is calculated using the theory of weak interactions with an intermediate boson. It is found that this theory cannot explain the experimental maximum at Z = 26. (auth)

6969 GENERALIZED GAUGE INVARIANCE AND CORRELATED BOSON FIELDS. H. Leutwyler (Universität, Bern). Helv. Phys. Acta, 35: 337-8(1962). (In German)

A site-dependent transformation of the continuous invariance group of the Dirac equation was formulated. The formalism was derived from the equation expressing the compatibility of the definitions of metrics and affine relationships as scalar products or parallel displacement of the base vector in spinor space. (J.S.R.)

6970 GAUGE GROUP AND SYMMETRIES OF THE ISOSPACE ASSOCIATED WITH THE NON-RELATIVISTIC ROTATOR. Pierre Hillion (Institut Henri-Poincare, Paris). J. Phys. Radium, 23: 398-406(July 1962). (In French)

It is pointed out that gauge invariance proceeds from one degree of freedom in the definition of two of the Euler angles and from the particular form of the isofields depending on this last one through complex exponentials. The application of Utiyama's formalism to the gauge group supplies the electromagnetic isofield and its interactions with the pions and nucleons. After proving the form (used in a preceding work) of the isofields associated with the multiplets of the isobaric spin, it is shown that the pion-nucleon interactions are invariant not only under the charge conjugation previously defined but also under the charge symmetry V and combined charge conjugation W operations. (auth)

6971 STUDIES ON THE NUCLEAR INTERACTIONS OF NINE-Bev (BILLION ELECTRON VOLT) PROTONS IN PHOTOGRAPHIC EMULSION. Eva Gombosi (Central Physical Research Inst., Budapest). Magy. Fiz. Folyoirat, 10: 265-91(1962). (In Hungarian)

Angle and energy measurements were conducted on plates irradiated with 9-Bev protons to establish the parameters of the nuclear interactions involved and to study the results by cascade and tunnel evaluation to gain an insight into the mechanism of the interactions. The emulsion contained both light (hydrogen, carbon, nitrogen, and oxygen) and heavy (silver and bromine) elements. Isolated (single-type), multiple, and intranuclear interactions (approximately 15% were nucleon-nucleon (N-N)-type and 85% nucleon-nucleus type) were studied. The integral collision angle and impulse distribution was determined for both the total shower and the grey particles. The average and minimum duration of the excited state caused by N-N interactions was estimated. Experimental techniques and methods of computation are described in detail. (OTS)

6972 ELEMENTARY PARTICLES AND PHOTRON THEORY. [PART] II. K. Nowak. Neue Physik, 3: Nos. 1-2, 1-34(1962-63). (In German)

The present section of the article on elementary particles and photron theory is concerned with the properties of the "elementary particles," their present classifications, and the existing conservation laws. Then the nature of a "lepton" and "baryon" charge as photron charges with various values smaller than the "electric elementary charge e" and different polarity is explained. The interaction of the elementary particles is then considered, and the explanations of the photron theory are compared with the present conceptions. An order-of-magnitude agreement is obtained with the strength of the "weak" interactions. A new classification of elementary particles is given. (tr-auth)

6973 NOTE ON THE BORN SERIES. J. E. Russell (Carnegie Inst. of Tech., Pittsburgh). Nucl. Phys., 38: 553-60(Nov. 1962). (In English)

The Born series for the non-relativistic elastic scattering amplitude is investigated for the most elementary type of non-central interaction, a potential between two spin one-half particles for which the departure from spherical symmetry is due to the tensor interaction. It is shown that sufficient conditions for convergence at zero energy are that the potential be static, bounded, of finite range, attractive wherever it does not vanish, and such that there is no resonance at zero energy and no bound state at any energy. Convergence is also obtained if the sign of the potential is reversed. (auth)

6974 AN INVESTIGATION OF COULOMB SCATTERING AMPLITUDES IN THE COMPLEX ANGULAR MOMENTUM PLANE. Stanley Fenster (Univ. of California, Los Angeles). Nucl. Phys., 38: 638-47(Nov. 1962). (In English)

An approach suggested by Regge to study scattering amplitudes analytically continued as functions of complex angular momentum is applied to the Schrödinger, Klein-Gordon, and Dirac equations with Coulomb potentials. It is found that the energy and angular momentum eigenvalues of bound states are given by the equation for the poles of the scattering amplitude at negative energies. There are no Regge pole resonances, i.e., there are no poles in the first quadrant of the l plane for positive energies. Sommerfeld-Watson integral representations are given in all three cases. In the relativistic cases a branch cut appears in the l plane. The physical interpretation for this is discussed. (auth)

6975 PHOTO-PRODUCTION OF CHARGED PIONS FROM NUCLEI. V. Devanathan (Univ. of Madras) and G. Ramachandran. Nucl. Phys., 38: 654-60(Nov. 1962). (In English)

The "elastic" photoproduction of charged pions from nuclei with one nucleon outside the closed shell or subshell is investigated. Explicit expressions have been obtained for the cross sections of such reactions and numerical computation has been carried out in the simple case $Si^{29}(\gamma,\pi^-)P^{29}$. The Chew-Low amplitude for the photoproduction from free nucleons has been used for calculational purposes using (a) free nucleon magnetic moments and (b) the actual magnetic moments within the nuclei.(auth)

6976 PRECISION MEASUREMENTS OF THE n-p TOTAL CROSS SECTION AT 0.4926 AND 3.205 Mev. C. E. Engelke, R. E. Benenson, E. Melkonian, and J. M. Lebowitz (Columbia Univ., New York). Phys. Rev., 129: 324-37(Jan. 1, 1963).

The n-p total cross section at 0.4926 Mev has been measured to be 6.202 b ± 0.18%. This measurement when combined with the latest results at zero energy, determines the n-p singlet effective range to be $(2.46 \pm 0.12) \times 10^{-13}$ cm. The uncertainty has been decreased by a factor of 2 from the best previous determination. The systematic uncertainty due to shape dependence effects is less than $\pm 0.04 \times 10^{-13}$ cm. The total n-p cross section at 3.205 Mev has been measured as 2.206 b ± 0.31%. This preliminary value was obtained in the process of measuring rate dependence effects to correct the n-p cross section at 0.4926 Mev for count rate dependence. The use of resonant (n,p) and (n,α) reactions for neutron detection in high-pressure gas scintillators is the most novel feature of the experimental method. An analysis is made of the propagation of the uncertainties in the various independent low-energy experiments into uncertainties in the calculated shape-independent cross section. The results of the analysis are presented as plots of percent cross section uncertainty versus neutron lab energy. (auth)

6977 ELASTIC SCATTERING OF NEGATIVE PIONS BY PROTONS AT 152 AND 226 Mev. S. Kellman, W. P. Kovacik, and T. A. Romanowski (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev., 129: 365-74(Jan. 1, 1963).

The differential elastic and total cross sections for the scattering of 152- and 226-Mev negative pions by protons have been measured with a liquid hydrogen target and scintillation counters. Analyses of the incident pion beams with a Cherenkov counter yielded higher electron contents than those deduced from range curves. Elastically scattered pions were distinguished from electrons among the scattered particles by use of a Cherenkov counter, or by demanding a coincidence between the scattered pion and recoil proton. The total cross sections measured were 63.7 ± 2.0 and 52.9 ± 1.4 mb at 152 and 226 Mev, respectively. With the present uncertainties, the real parts of the forward scattering amplitudes agree with the predictions of pion dispersion relations. (auth)

6978 PHOTON ASYMMETRY IN THE BREMSSTRAHLUNG OF TRANSVERSELY POLARIZED ELECTRONS. E. S. Sobolak and P. Stehle (Univ. of Pittsburgh). Phys. Rev., 129: 403-12(Jan. 1, 1963).

There is a left-right asymmetry in the bremsstrahlung emitted by transversely polarized electrons analogous to the left-right asymmetry in Mott scattering. The magnitude of this effect has been calculated from the second Born approximation, where it appears in the cross terms between the matrix elements of order Ze^3 and those of order Z^2e^5. Principal contributions come from the Feynman diagram in which the photon is emitted between the Coulomb interactions with the nucleus, while the largest terms from the diagrams with the photon emitted before or after both Coulomb interactions are of relative order v/c compared to the principal terms. The contributions of all three diagrams to relative order $(v/c)^2$ are included in the final result. As is the case in Mott scattering, the asymmetry in bremsstrahlung depends only on intermediate states which lie on the energy shell. The reason for this has not been investigated here. It does not seem feasible to integrate the cross section over electron momenta analytically. In order to reduce geometric complexity, the calculation is performed in detail for forward electron momentum. The matrix elements for this case are listed explicitly so that other polarization-dependent effects may be conveniently calculated. An outline of the evaluation of the integrals which appear, and a discussion of the divergences associated with the no-cutoff limit of the Coulomb field, as they apply to bremsstrahlung, are included. (auth)

6979 NEGATIVE PION CAPTURE IN HELIUM. S. G. Eckstein (Univ. of Chicago). Phys. Rev., 129: 413-26 (Jan. 1, 1963). (EFINS-62-11)

The capture rates of negative pions in He^4 into the three modes t + n, d + 2n, and p + 3n are calculated phenomenologically, using a two-nucleon capture model. The amplitudes which appear in the phenomenological interaction are evaluated by a comparison with the pion production cross sections; and the capture rates are compared with experiment. The calculated ratio of the triton mode to all captures within the energy range observed by Schiff, Hildebrand, and Giese is 30%, which is in good agreement with the experimental ratio of 1/3. (auth)

6980 PERIPHERAL CONTRIBUTIONS TO THE DIFFERENCE OF PARTICLE AND ANTIPARTICLE HIGH-ENERGY CROSS SECTIONS. Sidney L. Borison (Univ. of Washington, Seattle). Phys. Rev., 129: 427-33(Jan. 1, 1963). (TID-16318)

One-pion-exchange contributions to the differences between total cross sections of $\bar{p}$ and p on protons, as well as of π^- and π^+ on protons, are considered. It is found that the requirement of the correct sign for each difference determines the value of δ^2, the integration cutoff over momentum transfer. The calculated $\bar{p}-p$ difference is too small to explain the observed values in the range 10 Bev/c $\leq P_L \leq$ 30 Bev/c, and short-range contributions such as annihilation must still account for the difference. The $\pi^- - \pi^+$ difference with the correct sign (for $\delta^2 = \mu^2$) is also too small, but for $\delta^2 = 4\mu^2$ and $P_L = 4.5$ Bev/c it is more than twice the experimental value with the opposite sign. Since there is no annihilation effect for the $\pi^- - \pi^+$ difference, the process giving rise to the observed difference could even be twice as strong as previously suspected. Current notions concerning Regge poles indicate that one-ρ meson exchange should be most important. (auth)

6981 ROTATOR MODEL OF ELEMENTARY PARTICLES CONSIDERED AS RELATIVISTIC EXTENDED STRUCTURES IN MINKOWSKI SPACE. Louis de Broglie (Institut Henri Poincaré, Paris), David Bohm, Pierre Hillion, Francis Halbwachs, Takehiko Takabayasi, and Jean-Pierre Vigier. Phys. Rev., 129: 438-50(Jan. 1, 1963).

The purpose of this paper is to investigate some consequences of the assumption that elementary particles are not pointlike, but are rather, extended structures in Minkowski space. In terms of the hypothesis that the internal quantum states of such structures correspond to internal "rotator" levels belonging to the Hilbert space containing all irreducible finite-dimensional representations of the group SO_3^+ of three-dimensional complex rotations (isomorphic to the Lorentz group), we obtain a particle classification which recovers (including leptons) the Nishijima–Gell-Mann classification of elementary particles. In this way, we justify the empirical Nishijima–Gell-Mann relation between isobaric spin, strangeness, baryon number, and charge. Moreover, as will be shown in a second paper, the new internal ("hidden") degrees of freedom which correspond to isobaric spin, strangeness, and baryon number open up new possibilities for understanding qualitatively and quantitatively the elementary particle interactions and decays; while a simple extension of "fusion" theory yields possible external state vectors and equations associated with any given internal quantized states corresponding to known elementary particles. (auth)

6982 SPACE-TIME MODEL OF RELATIVISTIC EXTENDED PARTICLES IN MINKOWSKI SPACE. II. FREE PARTICLE AND INTERACTION THEORY. Louis de Broglie, (Institut Henri Poincaré, Paris), Francis Halbwachs, Pierre Hillion, Takehiko Takabayasi, and Jean-Pierre Vigier. Phys. Rev., 129: 451-66(Jan. 1, 1963).

New consequences of the idea that particles are extended structures in real space-time are examined. Starting from the general quantum equations for stable states established in paper I, the general form of solutions satisfying simultaneously the internal state equations and the external wave equations is discussed. One sees in particular that the external part depending on the particle's position x_μ necessarily corresponds to state vectors belonging to irreducible finite-dimensional representations of the Lorentz group L_4. Assuming then that the general interaction Hamiltonians are invariant under L_4 and our new internal isobaric spin group G, one justifies the usual semiempirical scheme of strong interactions (invariant under SO_3) and introduce weak interactions in isobaric spin space. The theory also implies couplings between external and internal motions and breaks automatically the symmetries of strong interactions, in a natural development of Sakurai's ideas. (auth)

6983 HIGH-FREQUENCY REGION OF THE SPECTRUM OF ELECTRON AND POSITRON BREMSSTRAHLUNG. R. J. Jabbur and R. H. Pratt (Stanford Univ., Calif.). Phys. Rev., 129: 184-90(Jan. 1, 1963).

The cross section for a bremsstrahlung process in which almost all the energy of an incident high-energy electron is transferred to the photon is calculated analytically, using techniques previously developed for atomic photoeffect. Only terms of relative orders a^4, a^2q^2, and q^4 are neglected, where $a \equiv Ze^2$ and q is the momentum of the outgoing low-energy electron (with $\hbar = c = m_e = 1$). Similar results are obtained for positron bremsstrahlung and pair production; previous work on the photoeffect is extended. The accuracy of these predictions is discussed, and they are compared with experiments. (auth)

6984 SEMI-PHENOMENOLOGICAL MODEL FOR MESON PRODUCTION IN HIGH-ENERGY NUCLEON-NUCLEON COLLISIONS. J. W. Olley and S. T. Butler (Univ. of Sydney). Phys. Rev., 129: 843-54(Jan. 15, 1963).

A "two-center" model is proposed for the description of meson production in high-energy nucleon-nucleon collisions. In this model the effect of one nucleon on the other is replaced by an equivalent interaction which frees pions "bound" in the second nucleon. The model takes into account "peripheral" collisions only and does not include mesons emanating from core-core collisions. A transverse momentum (p_T) distribution is obtained as a function of only the impact parameter and core radius. Our distributions agree well with experiment, the most probable p_T being 0.3–0.4 Bev/c. The angular distribution obtained does not deviate much from an isotropic distribution in the center-of-mass system of the emitting nucleon. (auth)

6985 SPIN ROTATION COEFFICIENTS IN π-N SCATTERING. Young S. Kim (Ohio State Univ., Columbus). Phys. Rev., 129: 862-5(Jan. 15, 1963).

The spin rotation coefficients of the recoil proton in π-N scattering are studied from the point of view of providing a means of resolving the present ambiguities in the phase-shift solution of the scattering cross section and the polarization of the recoil proton. There are six possible experiments four of which are independent, and the magnitude and the relative sign of the scattering matrix elements can uniquely be determined by four independent scattering experiments. (auth)

6986 PARTIAL AND TOTAL CAPTURE PROBABILITIES OF NEGATIVE MUONS BY C^{12}. M. Ruel and J. G. Brennan (Catholic Univ. of America, Washington, D. C.). Phys. Rev., 129: 866-9(Jan. 15, 1963).

The capture probability of negative muons by the C^{12} nucleus is calculated as a sum of partial transition rates to the individual levels of B^{12}. The calculation is based on an extreme single-particle shell model. The calculation is an application of the general formalism developed by Morita and Fujii for predicting the transition rate between two definite nuclear states, following muon capture. Regarding bound-state captures, the agreement between theory and experiment is good. An exception is the prediction concerning the 1.67-Mev level of B^{12}, the calculated transition rate being too large by a factor whose lower limit is about 2. This casts some doubts on the spin and parity assignments currently accepted for this level. The total capture probability is too small by a factor of 2, as is the ratio of unbound-to-bound captures. The discrepancy is accounted for in part by the existence of little-known, highly excited virtual states of B^{12}. These conclusions are of limited scope because of the use of the single-particle shell model. (auth)

6987 LOW-ENERGY PION-PION SCATTERING. [PART] II. Louis A. P. Balázas (Univ. of California, Berkeley). Phys. Rev., 129: 872-6(Jan. 15, 1963). (UCRL-10376)

A self-consistent calculation of low-energy π-π scattering is made in which, in addition to the usual P-wave resonance, an I = 0, D-wave resonance is also retained. The only free parameter is the pion mass. The resulting resonances have masses of 685 and 892 Mev, respectively, and the half-width is about 160 Mev in each case. The procedure consists of combining the Chew-Mandelstam and generalized Ball-Wong techniques with self-consistency. An outline is also given of a possible generalization of such a procedure to an arbitrary S-matrix process. (auth)

6988 ELASTIC μ^- SCATTERING IN NUCLEAR EMULSION. D. Kotelchuck, J. G. McEwen, and J. Orear (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 129: 876-9(Jan. 15, 1963).

An emulsion stack was exposed to a separated beam of $\sim 2 \times 10^7$ μ^- of energy 52 ± 8 Mev at the CERN synchrocyclotron. Muons with endings in a region near the incoming edge of the plates were traced back to scatters, thus discriminating in favor of events with momentum transfers from 100 to 160 Mev/c. The 78 events found give evidence that the muon behaves merely as a heavy electron, in contradiction to the anomalous muon-nucleus scattering reported in several cosmic-ray experiments. Our data indicate, however, a possibility of a small amount of scattering in excess of that predicted, particularly for momentum transfers >130 Mev/c. This may be ascribed either to unresolvable inelastic scattering, to inaccuracies in the parameters of the nuclear charge distribution, or to the breakdown in the representation of the many-body nucleus by a smoothed-out potential. Of the 78 events, one was an elastic scatter by hydrogen, which is consistent with the Mott scattering formula. (auth)

6989 CALCULATION AND APPLICATION OF THE DENSITY PROPAGATOR FOR A SELF-BOUND FERMION SYSTEM. I. THEORY. A. S. Reiner (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev., 129: 889-96 (Jan. 15, 1963).

The Martin-Schwinger-Puff theory for a many-fermion system is applied to a calculation of the appropriate density propagator. The real part of this function, the system's polarizability, is a measure for the lowest order change in energy due to a harmonic density ripple enforced on the infinite system. The imaginary part, the linear response function, yields the inelastic cross section for the scattering of a weak external agent. The linear response contains additional information on excited states and, in particular, on collective states, excited by an external field. The formalism necessitates the calculation of the self-energy of a particle and from it the optical model for nucleon scattering can be derived. The relation of the theory to perturbative and other nonperturbative approaches is discussed and a comparison is made with a calculation of the polarization energy of nuclear matter by Koltun and Wilets. (auth)

6990 PROPERTIES OF THE ONE-PARTICLE GREEN'S FUNCTION FOR NONUNIFORM MANY-FERMION SYSTEMS. A. J. Layzer (New York Univ., New York). Phys. Rev., 129: 897-907(Jan. 15, 1963).

Some general properties of the one-particle Green's function for nonuniform many-fermion systems and the associated single-particle interpretation of physical properties of such systems are discussed. In particular, the ground-state energy, the density of particles in the ground state, and the single-particle excitation spectrum are considered. The investigation is restricted to the case of a static external field and a system at zero temperature. Various general approximation methods are studied starting from one in which the self-energy operator is replaced by an Hermitian and energy-independent operator. (auth)

6991 SINGLE-PARTICLE EXCITATIONS IN A DENSE ELECTRON GAS CONTAINING A POSITIVE POINT CHARGE. A. J. Layzer (New York Univ., New York). Phys. Rev., 129: 908-25(Jan. 15, 1963).

The perturbative solution of the equation for the one-particle Green's function for the ideal problem of a dense infinite electron gas with neutralizing uniform positive background and a static "source" consisting of a fixed positive point charge of atomic number Z is investigated. The densities appropriate to the perturbation expansion are so high as to limit the quantitative applicability of the model to very dense metals or dense degenerate astronomical systems such as white dwarfs. Lowest order expressions for the non-Hermitian effective Hamiltonian of the single-particle excitation spectrum are derived. According to an interpretation discussed in a previous paper, the eigenvalues and eigenfunctions of the effective Hamiltonian correspond also to single-electron energy levels and wave functions associated with ground-state properties of the system. Some general properties of the induced charge density and of the corresponding polarization potential are discussed. The theory predicts the existence of a discrete spectrum of bound holes and its disappearance beyond a certain limiting value of the density, $n: n^{1/3} \simeq Z^2 a_0^{-1}$, where a_0 is the Bohr radius. This is a consequence of the fact that the lowest order polarization potential is a shielded Coulomb potential (Yukawa potential) with a range inversely proportional to the classical plasma frequency. This potential, derived here by a formal limiting process, is well known from the electron theory of metals where its derivation has been based on a linearized Thomas-Fermi treatment. In order for the discrete spectrum of bound holes to have physical reality it is necessary that the level width of these holes be less than the spacing of bound levels or less than the distance to the continuum limit. This condition is verified, at high densities, by a lowest order calculation of the level width in the same formal high-density limit that yielded the Yukawa potential. Approximate numerical estimates for the level width are then given for a considerably wider range of densities and values of Z. It is shown that, to a fair approximation, the level width depends on only two parameters: the ratio of the interparticle spacing to the Bohr radius and the ratio of the binding energy to the Fermi energy, provided that these parameters are less than or comparable to unity. It turns out that away from the limit of very small binding energies, the plasmon-emission mode gives an important contribution to the level width. An interesting consequence of the present work is that for low binding energies the "orbits" of bound holes may be considerably larger than the interparticle spacing. Some physical applications of the results, particularly to the problems of electron capture by a nucleus in a dense medium, and the x-ray spectrum of atoms in metals are briefly discussed. (auth)

6992 SAMPSON-SEITZ PROCEDURES AND THE STATIC RESPONSES OF NORMAL FERMION SYSTEMS. Ronald M. Rockmore (Brandeis Univ., Waltham, Mass.). Phys. Rev., 129: 926-36(Jan. 15, 1963).

It is shown that a differential characterization of Sampson-Seitz methods for calculating the static responses of a normal fermion system at zero temperature yields expressions for these quantities which are identical with those deduced by Landau from a semiphenomenological basis and by the author, in several instances, from spherical, time-independent, many-body perturbation theory. This connection is explicitly demonstrated for the Galilean invariance, magnetic susceptibility, and compressibility of a normal fermion system with translation-invariant interactions. The calculation of the magnetic susceptibility and compressibility of a dense electron gas is examined from both points of view. In the case of the magnetic susceptibility, it is shown that the contribution to α_c from graphs with two virtual excitations vanishes to $O(r_s)$ in agreement with the Sampson-Seitz calculation of Brueckner and Sawada. Although this demonstration is trivial by Sampson-Seitz methods, it is only a consequence of detailed calculation in Landau's formulation. It is found that $(1/K)(2/\rho R) = \alpha_c - 0.0676 \ln r_s + 0.255$, where K is the compressibility, ρ is the density, and R is the rydberg. (auth)

6993 QUANTUM CELL MODEL FOR BOSONS. H. A. Gersch and G. C. Knollman (Georgia Inst. of Tech., Atlanta). Phys. Rev., 129: 959-67(Jan. 15, 1963).

An approach is presented toward validating the assumption that the ground state of bosons with repulsive interactions at low densities is characterized by macroscopic occupation of the zero momentum level. We use a cell model which affords a simple description of the high-density region, where fluctuations in number density are small and where no single-particle level is macroscopically occupied. As the density decreases, fluctuations increase, and we reach a critical density at which the small fluctuation approximation becomes unstable with respect to plane wave states of zero momentum. At this critical density, the single-particle energy gap disappears, and the dependence of excitation on momentum changes from quadratic to linear, for small values of momentum. (auth)

6994 OVERLAPPING FINAL-STATE INTERACTIONS. Ronald F. Peierls and Jan Tarski (Inst. for Advanced Study, Princeton, N. J. and Univ. of Wisconsin, Madison). Phys. Rev., 129: 981-90(Jan. 15, 1963). (TID-16631)

A simple model for a production process with a three-body final state is constructed. Two pairs of particles in the final state are assumed to interact, perhaps strongly, and the structure of the resulting interaction is examined. The dynamics of the model is defined by a dispersion relation, which yields a singular integral equation. This equation is solved in the case of large mass of the particle which is common to the two interacting pairs. (auth)

6995 CP INVARIANCE AND K_1^0 REGENERATION. Malcolm C. Whatley (Univ. of Wisconsin, Madison). Phys. Rev. Letters, 9: 317-18(Oct. 1, 1962).

If the decay of K^0 mesons fails to be invariant under CP, one can prepare, by regenerating K_1 from a K_2 beam in a dense medium, states in which the time dependence of the two-pion mode of decay reveals both the magnitude and phase of the mixing of states (ϵ) of definite CP in the eigenstates of the complex mass matrix. Using K-meson scattering data for iron and assuming that CP invariance is violated only by the interactions that give rise to the leptonic decays, the magnitude of ϵ is determined as $|\epsilon| \approx 0.003$. A formula is derived for the intensity of decays from a pure K_2 beam that enters a dense plate and emerges as a K_1-K_2 mixture. The point is emphasized that by doing two experiments on plates of different selected thicknesses the phase of ϵ can be measured. (H.D.R.)

6996 SPECULATIONS CONCERNING THE $\Delta S = -\Delta Q$ REACTIONS AND THE INTERMEDIATE BOSON STRUCTURES IN WEAK INTERACTIONS. T. D. Lee (Stanford Univ., Calif.). Phys. Rev. Letters, 9: 319-21(Oct. 1, 1962).

Previous work on various decays of strange particles indicate the possible existence of $\Delta S = -\Delta Q$ reactions. The presence of such reactions suggests the existence of at least six different kinds of bosons. The interactions of the intermediate bosons are constructed to show that a single set of six bosons (consisting of two positive, two neutral, and two negative particles) is sufficient to produce the following patterns of the usual weak interactions: existence of $\Delta S = -\Delta Q$ reactions in the decay of strange particles, absence of $|\Delta S| > 1$ reactions, validity of $|\Delta \vec{I}| = \frac{1}{2}$ rule for all nonleptonic decays of strange particles, and absence of neutral lepton currents. (H.D.R.)

6997 PRODUCTION OF PION RESONANCES IN π^+p INTERACTIONS. C. Alff (Columbia Univ., New York), D. Berley, D. Colley, N. Gelfand, U. Nauenberg, D. Miller, J. Schultz, J. Steinberger, T. H. Tan, H. Brugger, P. Kramer, and R. Plano. Phys. Rev. Letters, 9: 322-4(Oct. 1, 1962).

About ten thousand interactions of positive pions with protons were studied with the BNL 20-inch liquid hydrogen bubble chamber. The cross sections are tabulated for the various production processes at incident momenta of 2.34, 2.62, and 2.90 Bev/c. A striking feature of the interactions is the dominance of pionic resonant states. This is shown in mass distributions for $\pi^+ - \pi^0$ pairs from $\pi^+ + p \rightarrow \pi^+ + p + \pi^0$ events, for $\pi^+ - \pi^-$ pairs from $\pi^+ + p \rightarrow \pi^+ + p + \pi^+ + \pi^-$ events, and for $\pi^+ - \pi^- - \pi^0$ triplets from $\pi^+ + p \rightarrow \pi^+ + p + \pi^+ + \pi^- + \pi^0$ events. Production of ρ, η, and ω particles from the interactions is investigated. Production cross sections, masses, and widths of resonant states are tabulated, and mass distributions of π^+-p pairs and center-of-mass production angles for ρ's, η's and ω's are plotted. (H.D.R.)

6998 DECAYS OF THE ω AND η MESONS. C. Alff (Columbia Univ., New York), D. Berley, D. Colley, N. Gelfand, U. Nauenberg, D. Miller, J. Schultz, J. Steinberger, T. H. Tan, H. Brugger, P. Kramer, and R. Plano. Phys. Rev. Letters, 9: 325-7(Oct. 1, 1962).

Studies are presented on correlations among the decay products of the ω and η mesons and branching ratios of competing decay modes. Energy correlations in the $\pi^+ - \pi^- - \pi^0$ decay modes are examined using Dalitz plots for the ω and η, density curves, and mass distribution of pion pairs. Neutral decays of ω and η are studied by a missing-mass spectrum for events of the type $\pi^+ + p \rightarrow \pi^+ + p^+$ missing mass. The two-pion ω decay, $\omega \rightarrow \pi^+ + \pi^-$, spectrum and branching ratio are discussed. (H.D.R.)

6999 EVIDENCE FOR $K^+ \rightarrow \pi^+ + \pi^- + e^+ + \nu$ DECAY MODE. E. L. Koller, S. Taylor, T. Huetter, and P. Stamer (Stevens Inst. of Tech., Hoboken, N. J.). Phys. Rev. Letters, 9: 328-30(Oct. 1, 1962).

A K^+-meson decay of particular interest has been found during studies of K^+ endings in 600μ Ilford G-5 emulsion. The event appears to be an example of a K^+ decaying into two particles of pion or muon mass, one electron, and one or more neutral particles. A thorough analysis of the event is presented with a number of possible decay modes considered and rejected. The most likely possibility for the event is $K^+ \rightarrow \pi^+ + \pi^- + e^+ + \nu$. (H.D.R.)

7000 ON THE SPIN OF THE K* RESONANCE. William Chinowsky, Gerson Goldhaber, Sulamith Boldhaber, Wonyong Lee, and Thomas O'Halloran (Univ. of California, Berkeley). Phys. Rev. Letters, 9: 330-2(Oct. 1, 1962). (UCRL-10428)

The reaction $K^+ + p \rightarrow K^+ + \pi^- + p + \pi^+$ was studied in the 20-inch Brookhaven bubble chamber at a K^+ momentum of 1.96 Bev/c. The production of the K* resonance in the reaction permitted the identification of the K* as a vector meson. The distribution in the angle α between the outgoing K^+ in the K* cm system and the incident K^+ direction was examined, and a strong anisotropy was found that can be fitted with $\cos^2 \alpha$. This evidence was combined with previous attempts to assign spin one to the K*. Therefore, the K-K* relative parity is even. For odd KAN parity this leads to spin and parity of 1^- for the K*. (H.D.R.)

7001 DETERMINATION OF ρ,γ,π COUPLING CONSTANT FROM π^+ PHOTOPRODUCTION. C. S. Robinson (Univ. of Illinois, Champaign), P. M. Baum, L. Criegee, and J. M. McKinley. Phys. Rev. Letters, 9: 349-51(Oct. 15, 1962).

Two previous works produced photoproduction cross sections, with the inclusion of the contribution of the ρ-meson interaction, and a set of data on π^+ photoproduction from

hydrogen. These two sets of results are combined to determine the ρ,γ,π coupling constant Λ. The theoretical cross sections incorporating the contribution of the ρ meson were computed using the photoproduction amplitudes previously derived. Using a 272.6 Mev x-ray beam, relative differential cross sections for photoproduction of 42.4 Mev π^+ mesons from hydrogen were measured. Differential cross sections versus center-of-mass angle with no ρ meson contribution are shown for both measured and calculated values. All theoretical curves disagree violently with the experimental points. Theoretical curves including the ρ meson contribution are in good agreement with experiment, and depending on the value of ρ meson mass used, Λ is concluded to be -1.2 ± 0.4 or -1.5 ± 0.5. (H.D.R.)

7002 PRODUCTION OF ANTI-ISOBAR, ISOBAR PAIRS IN $\bar{p}$-p COLLISIONS. T. Ferbel (Yale Univ., New Haven), J. Sandweiss, H. D. Taft, M. Gailloud, T. E. Kalogeropoulos, T. W. Morris, and R. M. Lea. Phys. Rev. Letters, 9: 351-4(Oct. 15, 1962).

The production of $\bar{N}_1^*$, has been observed in a hydrogen bubble chamber study of $\bar{p}$-p interactions. A 3.25 Bev/c antiproton beam was used to produce 304 events of the type $\bar{p} + p \rightarrow \bar{p} + p + \pi^+ + \pi^-$. The four-prong events were analyzed and determined to occur primarily by production of a pair of $T = 3/2$, $J = 3/2$ pion-nucleon isobars: $\bar{p} + p \rightarrow N_1^{*2+} + \bar{N}_1^{*2-}$, $N_1^{*2+} \rightarrow \pi^+ + p$, $\bar{N}_1^{*2-} \rightarrow \pi^- + \bar{p}$. The experimental mass spectra of the π^+-p and π^--$\bar{p}$ combinations and the dependence of the reaction cross section on the square of the four-momentum transfer to the π^+-p system are shown and discussed. The experimental results are compared and found to be consistent with some of the consequences of the single-pion exchange model for isobar pair production. (H.D.R.)

7003 HIGH-ENERGY BEHAVIOR OF ELASTIC-SCATTERING AMPLITUDES. M. Sugawara and A. Tubis (Purdue Univ., Lafayette, Ind.). Phys. Rev. Letters, 9: 355-8(Oct. 15, 1962).

Presented are some properties of high-energy elastic-scattering amplitudes at and near the forward direction that follow rigorously from analyticity requirements. The discussion is restricted mainly to pion-pion scattering. The amplitudes are assumed analytic in the sense of Mandelstam with respect to the covariant energy and momentum transfer. The forward elastic amplitudes are required to become imaginary at infinite energy. No specific assumptions concerning the number of subtractions and/or analyticity in the angular momentum plane are made. The main conclusions of the analysis are listed, and an example is given for application to other amplitudes. (H.D.R.)

7004 MOVING POLES AND ELEMENTARY PARTICLES. Reinhard Oehme (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters, 9: 358-60(Oct. 15, 1962).

The general notions of relativistic dispersion theory and an assumption concerning the absence of a natural boundary in the complex angular momentum plane are used to show that the interpolating partial-wave functions $F(s,\lambda)$ have no s-independent poles in the λ plane, at least for $\mathrm{Re}\lambda > -1/2$. This implies that a constant total cross section for $t \rightarrow \infty$ in an elastic crossed channel must be due to a moving pole $\lambda = \alpha(s)$, $\alpha(0) = 1$, because $A_t(s,t) \sim C(s)t^{\alpha_0}$ with $\alpha_0 = 1$ cannot exist for a whole neighborhood of $s = 0$. Using additional assumptions, it is indicated that the invariant scattering amplitude $F(s,t)$ has no single-particle poles describing particles with spin larger than one that are not manifestations of a pole trajectory in the λ plane. (H.D.R.)

7005 NEUTRINOS AND THE ARROW OF TIME IN COSMOLOGY. J. V. Narlikar (Fitzwilliam House, Cambridge, Eng.). Proc. Roy. Soc. (London), Ser. A, 270: 553-61(Dec. 11, 1962).

An approach to time-symmetric electrodynamics is applied to the neutrinos. It is shown that in some cosmological models neutrinos traveling both into the past and the future exist, whereas in others only those going into the future can exist. The Einstein–de Sitter and the steady-state models are the respective examples of the two cases. A way of testing the various cosmologies by means of neutrino emitters and receivers is suggested. (auth)

7006 ON THE SINGULARITY OF t-MATRIX OF INTERACTING FERMION SYSTEMS. Shuichiro Yamasaki (Osaka Univ.). Prog. Theoret. Phys. (Kyoto), 28: 407-23 (Sept. 1962).

The application of Brueckner's perturbation approach to interacting Fermion systems is prevented by the poles of the t-matrix which can be present for finite as well as infinite systems if the interaction is attractive. The singularity is removed if the contribution to the energy from diagrams involving two hole labels are taken into account. These diagrams are not necessarily of ladder type and correspond to the possibility that a scattered pair of particles can go to the levels which they have left in the unperturbed state. Though the removal of poles makes one entertain a hope for the perturbation approach to finite systems, it is discussed that the same is not the case with infinite systems. It is pointed out that the difficulty in dealing with infinite systems is not caused by the pairs corresponding to the poles as is usually considered to be, but is due to pairs lying more closely to the Fermi surface. (auth)

7007 PHOTOPION PRODUCTION AND $(\gamma,3\pi)$ INTERACTION. II. POLARIZATION OF THE RECOIL PROTON. Masaaki Kato (Tokyo Univ.) and Masaaki Kawaguchi. Prog. Theoret. Phys. (Kyoto), 28: 424-32(Sept. 1962).

Effects of the $(\gamma,3\pi)$ interaction on the polarization of the recoil proton from neutral pion photoproduction are investigated for 450 Mev and 600 Mev gamma rays. It is found that this interaction with a positive effective coupling constant contributes to the polarization negative in sense. The effect is surprisingly large for the recoil proton from large angle pion production, namely for the forward proton, while the effect on the angular distribution is only within experimental error. (auth)

7008 ON THE YUKAWA TYPE INTERACTIONS BETWEEN HYPERONS AND MESONS. Seibun Sasaki (Kumamoto Univ., Japan). Prog. Theoret. Phys. (Kyoto), 28: 459-70(Sept. 1962).

Assuming that the Fermions are of parity mixing, the possibility of reconciling the parity conservation with the strangeness conservation in the Yukawa type interaction between hyperons and mesons is investigated. This can be done when all interactions are of VA-type or of SPT-type exclusively. If there is any evidence for VA-type interaction, then all other interactions, both weak and strong, should be of VA-type. As the weak interactions are agreeable to VA-type from the estimation of the degree of the parity violation, it is concluded that the interactions under consideration are exclusively of VA-type. The introduced parameter indicating the rate of parity mixing can be estimated from anisotropy of the decay interaction. (auth)

7009 e-μ TRANSITIONS INDUCED BY ELECTROMAGNETIC INTERACTIONS. Toshio Kitagaki (Tohuku Univ., Sendai) and Kiyoshi Nakayama. Prog. Theoret. Phys. (Kyoto), 28: 471-8(Sept. 1962).

The muon production by electron collisions, $e^- + (Z) \rightarrow \mu^- + (Z)$ and $e^- + e^- \rightarrow \mu^- + e^-$, is investigated by using a

phenomenological and gauge invariant ($\mu e\gamma$) interaction. Theoretical results are derived from inverse processes, $\mu \rightarrow e + \gamma$, $\mu^+ + e^- \rightarrow \gamma + \gamma$, $\mu \rightarrow 3e$ and $\mu^- + (Z) \rightarrow e^- + (Z)$. The cross sections for the muon production reactions under the pion threshold are $\sigma(e^- + (Z) \rightarrow \mu^- + (Z)) \approx 10^{-46} Z^2$ cm^2 and $\sigma(e^- + e^- \rightarrow \mu^- + e^-) \lesssim 10^{-47}$ cm^2 under reasonable assumptions. (auth)

7010 ZEROS OF SCATTERING AMPLITUDE AND CONSISTENCY OF DISPERSION RELATION. Seiya Aramaki (Tokyo Univ. of Education). Prog. Theoret. Phys. (Kyoto), 28: 479-88(Sept. 1962).

The validity of the necessary condition for the existence of solutions of pion-nucleon forward dispersion relation is examined using experimental data. The position of two zeros of the scattering amplitude is determined on the imaginary axis. The position of zeros on the real axis depends critically on the values of the S-wave scattering lengths. If we use Hamilton-Woolcock's data, two zeros must exist in the unphysical region and not in the physical region. If we use Orear's data, there is a little possibility of existence of zeros on the real axis. By imposing the further condition which can be derived by requiring consistency of dispersion relation at resonance energy, it is shown that the data of Orear are more promising than that of Hamilton-Woolcock. With Orear's data on the S-wave scattering lengths and with existence of appropriate zeros, the necessary condition can be satisfied by the present experimental data. (auth)

7011 ON CLASSIFICATION OF INTERACTIONS. POSSIBILITY OF EXISTENCE OF A NEW BOSON COUPLED WITH Λ AND μ. Reiji Sugano (Osaka City Univ.). Prog. Theoret. Phys. (Kyoto), 28: 508-16(Sept. 1962).

Assuming the existence of a new boson χ which couples only with Λ and μ, interactions are classified on the basis of the Sakata model into the superstrong, the charge independent strong, and the weak interactions. Properties of the χ field are investigated. (auth)

7012 ON THE MASS LEVELS OF PARTICLES AND RESONANCE STATES. Yasuhisa Katayama (Kyoto Univ.). Prog. Theoret. Phys. (Kyoto), 28: 546-59(Sept. 1962).

The regularities among the mass levels of particles and their resonance states are discussed by constructing the empirical mass formula. The validity of the proposed mass formula for each value of the total angular momentum can be guaranteed by the coexistence of group of levels with the same angular momentum. With the deduction of the formula the Sakata model with the full symmetrical representation of levels is used in order to clarify the connection between the formulas for different angular momentums. (auth)

7013 MESON REACTIONS AT VERY HIGH ENERGY. Shigeo Minami (Osaka Univ.). Prog. Theoret. Phys. (Kyoto), 28: 560-2(Sept. 1962).

The effects of the process of heavy meson exchange in high-energy meson reactions are studied. The difference between (π^-,p) and (π^+,p) total cross sections is discussed in terms of a model for elementary particles. (W.D.M.)

7014 STRANGE-PARTICLE RESONANT STATES AND MESON REACTIONS. Shigeo Minami (Osaka City Univ.). Prog. Theoret. Phys. (Kyoto), 28: 566-8(Sept. 1962).

A model is suggested for the reaction mechanism of M-meson production in (π^-,p) collisions. (W.D.M.)

7015 ON THE MASS GAUGE INVARIANCE. Akira Inomata (Rensselaer Polytechnic Inst., Troy, N. Y.). Prog. Theoret. Phys. (Kyoto), 28: 569-71(Sept. 1962).

Some consequences of gauge invariance are explored on the assumption that no experimental measurement determines the phase of mass of an elementary particle. If the mass has a phase factor the phase could be removed by an adequate gauge transformation without any alteration in the physical situation. It is concluded that the principle of mass gauge invariance can be complementary to partial invariance. (W.D.M.)

7016 ON THE DECAY INTERACTION OF BARYONS. Ken-ichi Ono (Tokyo Univ.). Sci. Papers Coll. Gen. Educ., Univ. Tokyo, 12: 15-17(June 1962).

Assuming the existence of a standing neutrino (mass = energy = momentum = 0, no parity, angular momentum $\neq$ 0), an investigation is made of non-leptonic processes and particles. A structural scheme for the baryons and bosons is presented, taking this standing neutrino as a structural component. (T.F.H.)

7017 TWO-PHOTON EXCHANGE IN ELECTRON-PROTON SCATTERING. Rudolf Rodenberg (Universität, Frankfurt am Main). Z. Naturforsch., 17a: 1038-9(Nov. 1962). (In German)

The dispersion theory was used in handling the variation of the Rosenbluth formula for use in calculation of the two-photon exchange in electron-proton scattering. (M.C.G.)

7018 INVESTIGATION OF ELECTRON AVALANCHE WITH A MULTISTAGE IMAGE INTENSIFIER. K. H. Wagner and H. Raether (Universität, Hamburg). Z. Physik, 170: 540-4(1962). (In German)

Using a high-gain image intensifier and a pulsed discharge gap, electron avalanches were photographed by means of the light emitted as a result of excitation processes by electron impact accompanying ionization. Principles and sensitivity of the method are briefly discussed. Electron drift velocities in nitrogen were measured, and the range of mean energy of agitation of electrons was derived from the photographs taken. Preliminary data were also obtained for argon. (auth)

7019 AZIMUTHAL ANGULAR DISTRIBUTION OF SECONDARY PARTICLES PRODUCED IN HIGH-ENERGY INTERACTIONS. A. P. Mishakova and B. A. Nikolskii. Zh. Eksperim. i Teor. Fiz., 43: 1213-22(Oct. 1962). (In Russian)

By the method of pair angular correlations, a study is made of the azimuthal angular distributions of secondary particles produced in interactions of high-energy nucleons. The conclusion is drawn that the azimuthal angular distributions are close to isotropic. The azimuthal angular distributions of secondary particles in cosmic showers are analyzed from the viewpoint of the validity of the model of formation of an intermediate excited state and the model of fire balls. The conclusion is drawn that if the fire ball model holds, the direction of motion of the fire balls coincides with the direction of motion of the colliding particles; the model of intermediate excited state (with large magnitude of angular momentum) contradicts the isotropy of the azimuthal angular distribution. (auth)

7020 GENERATION OF π^0-MESONS IN THE COULOMB FIELD OF THE NUCLEUS. V. V. Barmin, Yu. S. Krestnikov, E. V. Kuznetsov, A. G. Meshkovskii, Yu. P. Nikitin, and V. A. Shebanov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1223-30(Oct. 1962). (In Russian)

A xenon bubble chamber is used to investigate the effect of generation of π^0 mesons by 2.8-Bev/c π^- mesons in the Coulomb field of the xenon nucleus ($\pi^- + Xe \rightarrow \pi^- + \pi^0 + Xe$). The cross section for this reaction in the interval of ejection angles of the π^- mesons θ between 3 and 30° is σ_c = 4.4 + 1.6 mb. The angular distribution of the reaction has

a sharp peak in the region of angles $\theta < 10°$. A relation is derived connecting the cross section with the cross section of the photoprocess $\gamma + \pi^- \rightarrow \pi^- + \pi^0$ which was found, on the average, to be 0.6 ± 0.2 mb in the interval $4\ m^2 \leq w^2 \leq 21\ m^2$ (w is the total energy of the generated mesons in their cms). (auth)

7021 POLARIZATION EFFECTS IN THE RADIATION DECAY OF π-MESONS. S. A. Gadzhiev and A. I. Mukhtarov (Azerbaidzhan State Univ., USSR). Zh. Eksperim. i Teor. Fiz., 43: 1275-80(Oct. 1962). (In Russian)

An investigation is made of the polarization effects in the decay $\pi \rightarrow e(\mu) + \nu + \gamma$ for variants V, A of weak direct interaction. Selection rules are found for the correlations of longidinal polarizations of spin of the decay products. It is shown that the electrons (positrons) are longitudinally polarized in opposite directions. By measuring the energy spectrum of electrons (positrons) and the angular distribution of photons (electrons) alone, it is possible to verify the correctness of the selection rules obtained and to get information about the predominance of V − A and V + A variants of weak interaction. Such information cannot be obtained from the energy distribution of photons. (auth)

7022 ON POSSIBLE DECAYS OF NEW MESONS. I. Yu. Kobzarev and L. B. Okun (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1288-95(Oct. 1962). (In Russian)

Evaluations of the probabilities of the decays of nonstable mesons are given. It is shown that in certain cases the small widths of decays may be accounted for by purely kinematic factors. The small widths of pion decays result in the fact that radiative decays (with the emission of photons) may be substantial. (auth)

7023 DETERMINATION OF THE AMPLITUDES OF π-MESON PRODUCTION IN THE COLLISION OF A NEUTRINO WITH A NUCLEON BY MEANS OF DISPERSION RELATIONS. Nguyen Van-hieu (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1296-1300(Oct. 1962). (In Russian)

The properties are studied of the amplitudes of π-meson production in collisions of a neutrino with a nucleon; one-dimensional dispersion relations are written for these amplitudes, and solutions are obtained of the integral equations on the assumption that the P-wave is predominant and the contribution of other waves to the imaginary parts of the amplitudes can be neglected. A comparison of obtained results with experiment permits to verify the V−A theory of weak interaction. (auth)

7024 THE EFFECT OF ππ-INTERACTION ON s- AND p-WAVES OF πN-SCATTERING. P. S. Isaev and V. A. Meshcheryakov (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1339-48 (Oct. 1962). (In Russian)

On the basis of the Mandelstam picture, account is taken of the effect of ππ interaction in s and p waves of πN scattering. Transition to partial waves is effected by means of combining dispersion relations for forward and backward scattering. The equations for s^- and p^- waves are compared with experimental data on the phases of πN scattering. Satisfactory agreement is obtained up to incident π-meson energies ~500 Mev in the laboratory coordinate system. It is shown that ππ interaction significantly affects the energy dependence of the s^- and p^- phase even at low energies, and up to ~400 Mev (in the laboratory system) produces but a slight effect on the behavior of the $p_{\frac{3}{2}}^-$ phase. (auth)

7025 SCATTERING OF γ-QUANTA AND POLARIZABILITY OF NUCLEI AND NUCLEONS. L. I. Lapidus (Joint Inst. of Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1358-61(Oct. 1962). (In Russian)

The definition of the polarizability of atomic nuclei and nucleons which is based on the dispersion relations and the spin structure of γ-ray scattering amplitude is discussed. An estimation of the magnetic polarizability of the proton is obtained. The applications of crossing symmetry are indicated for the polarizability of nuclei with arbitrary spins. (auth)

7026 ON CERTAIN INTERFERENCE PHENOMENA IN $K^0\overline{K}^0$ SYSTEMS. V. I. Ogievetskii and M. I. Podgoretskii (Joint Inst. of Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1362-4(Oct. 1962). (In Russian)

The nature of Pais–Piccioni beats in decays of a $K^0\overline{K}^0$ pair is studied. These beats prove to be essentially dependent upon the relative weight and phase difference of states of the $K^0\overline{K}^0$ system with even and odd orbital angular momenta. (auth)

7027 PHASE SHIFT ANALYSIS OF NUCLEON-NUCLEON SCATTERING AT 40, 95, 147 AND 310 Mev. Yu. M. Kazarinov and I. N. Silin (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1385-93(Oct. 1962). (In Russian)

Simultaneous phase-shift analysis of np and pp scattering is carried out. The phase-shift sets thus obtained are given. The π-meson-nucleon interaction constant derived is consistent with the value 0.08. An attempt is made to determine the π-meson mass from data on nucleon-nucleon scattering. The mass value obtained does not contradict the well known value. (auth)

7028 ANALYTIC PROPERTIES OF PARTIAL AMPLITUDES. Yu. M. Malyuta (Inst. of Physics, Academy of Sciences, Ukrainian, SSR). Zh. Eksperim. i Teor. Fiz., 43: 1397-9(Oct. 1962). (In Russian)

The diagram technique is employed for determining the nearest singular points of partial amplitudes in ππ scattering. (auth)

7029 ATTENUATION OF ELECTROMAGNETIC WAVES IN AN INHOMOGENEOUS MEDIUM RELATED TO TRANSITION RADIATION. V. Ya. Eidman (Inst. of Radiophysics, Gor'kii State Univ., USSR). Zh. Eksperim. i Teor. Fiz., 43: 1419-23(Oct. 1962). (In Russian)

It is shown that in an inhomogeneous medium electromagnetic waves can be absorbed as a result of variation of the properties of the medium. The relation between this mechanism of wave absorption and transition radiation from charged particles of the medium is established by employing the Kirchhoff theorem. (auth)

7030 CALCULATING THE INVARIANT PHASE VOLUME OF N-PARTICLES. V. A. Kolkunov (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1448-55(Oct. 1962). (In Russian)

A picture of an invariant phase volume for N-particles is obtained in the form of a one-fold contour integral. The phase volume is expanded in infinite series depending on the relation between the masses of particles and the total energy of the system. A simple approximate formula is obtained by the saddle point method. (auth)

7031 ON THE CONVERSION OF AN ELECTRON-POSITRON PAIR INTO A μ-MESON PAIR. N. A. Guliev and E. M. Epshtein (Inst. of Physics, Azerbaidzhan Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1517-20(Oct. 1962). (In Russian)

The cross section is calculated for the process $e^- + e^+ \rightarrow \mu^- + \mu^+$ with account taken of the invariant smearedness of the electron (positron) and muons. (auth)

7032 THE LOW PROBABILITY OF THE PROCESSES $\mu \rightarrow e + \gamma$, $\mu \rightarrow e + e + e$ AND NEUTRAL CURRENTS IN WEAK INTERACTIONS. B. Pontekorvo (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1521-3(Oct. 1962). (In Russian)

It is pointed out that the introduction of symmetrical neutral currents, in addition to charged currents, in weak interactions permits accepting a very small probability of the decay processes $\mu \rightarrow e + \gamma$ and $\mu \rightarrow e + e + e$ even if there is only one kind of neutrino in nature. (auth)

7033 ON CERTAIN THRESHOLD SINGULARITIES IN TOTAL CROSS-SECTIONS OF PARTICLE INTERACTIONS. N. P. Klepikov and V. V. Fedorov (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1524-5(Oct. 1962). (In Russian)

The singularities of total cross sections for particle interaction near the formation thresholds of two particles are investigated. The singularity of the total cross section of π^+p in the threshold of the reaction $\pi^+p \rightarrow K^+\Sigma^+$ is considered. (auth)

7034 REGGE FERMION-POLES AND THE ASYMPTOTICS OF MESON-NUCLEON SCATTERING THROUGH LARGE ANGLES. V. N. Gribov (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1529-34(Oct. 1962). (In Russian)

The trajectories of the Regge poles, describing a set of fermions (and which have a direct physical meaning for half integer angular momentum values), are discussed. Namely, it is demonstrated that the poles of scattering amplitudes $f^j_+(u)$ and $f^j_-(u)$ in states with moment j and parity $(-1)^{j+1/2}$ should coincide when the square of the energy in the center-of-mass system u tends to zero, and, should become complex conjugate when $u < 0$. This leads to a entirely specific character of amplitudes of elastic meson-nucleon scattering in the region of angles close to 180°. (auth)

7035 $\pi\pi$-INTERACTIONS IN MULTIPLE PRODUCTION OF π-MESONS IN πp-COLLISIONS. M. S. Ainutdinov, S. M. Zombkovskii, S. Ya. Nikitin, Ya. M. Selector, and V. N. Shulyachenko (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1543-6(Oct. 1962). (In Russian)

In an investigation of $\pi\pi$ interactions in π^-p collisions at an energy of 7.2 Bev, resonance states were found for two π mesons of the same charge and the mass values of 0.33, 0.44, 0.58, 0.76, and 0.99 Bev. Similar resonances were found for the $\pi^+\pi^-$ and $\pi^-\pi^0$ systems at the same mass values. An assumption is put forward of the possibility of isotopic and mechanical spin degeneracy in strong interactions. (auth)

7036 PHOTOPRODUCTION OF π^0 MESONS IN HYDROGEN AND DEUTERIUM AT SMALL ANGLES. A. S. Belousov, S. V. Rusakov, E. I. Tamm, and L. S. Tatarinskaya (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1550-2(Oct. 1962). (In Russian)

Previously described experiments on the measurement of the cross section ratio for $\gamma + d \rightarrow (d + \pi^0)/n + p + \pi^0)$, $\gamma + p = p + \pi_0$ near threshold energy, were extended to the meson $\theta_\pi \sim 0^0$ emission angle. In contrast to the previous experiments, the differential cross sections were measured directly, the π^0 mesons were recorded with an ordinary γ telescope by two quantum decay, and the intensity of the bremsstrahlung was measured with a quantometer. The differential cross sections and the ratio of cross sections for π^0 photoproduction in hydrogen and deuterium show that at $\theta_\pi \sim 0^0$ the results are in agreement with theoretical calculations for 200 to 250 Mev. At less than 200 Mev the results are about 2 standard deflection factors higher than theoretical. It is postulated that the discrepancy is due to the π^0 contribution from π^+ scattering with π^+ recharge at small energies $\sigma_+ \gg \sigma_0$. (R.V.J.)

7037 ON THE POSSIBILITY OF FINDING NEUTRAL CURRENTS IN NEUTRINO EXPERIMENTS. S. S. Gershtein, Wan-hien Nguen, and R. A. Eramzhyan (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1554-6(Oct. 1962). (In Russian)

Observation of neutral currents by means of neutrino experiments was attempted. Excitation of Li^7 was used as an example. The ground state of Li^7 is characterized by $J = 3/2^-$ and $T = 1/2$ and the excited state is characterized by $J = 1/2^-$ and $T = 1/2$ at $\Delta E = 480$ kev. The wave functions of the ground and excited state in $\underline{b}_0$ calculations are obtained by mixing configurations with a pair potential expressed by Rosenfeld exchange variations with parameters $\xi = 2.1$ Mev, $L/K = 6$, and $K = -0.9$, resulting in $\underline{b}_0 = 2.56$. The cross section is averaged by reactor neutrino spectra $\rho_\nu(E)$. For $\overline{\nu} + p \rightarrow e^+$ the neutrino cross section from a reactor is 6.7×10^{-43} cm^2 with polarization in the direction of the antineutrino. The S. Bludman (Nuevo Cim. 9: 433(1958)) scheme $L' = G/\sqrt{2}\ (\overline{p}\hat{O}\nu)\ (\overline{N}\hat{O}_{\tau_3}N)$, $\hat{O} = \gamma_\mu(1 + \gamma_5)$ shows the identity of μ and neutrino. The presented scheme was generalized for the case $\nu_\mu \neq \nu_e$. (R.V.J.)

7038 COMBINED EMISSION IN UNIFORM CHARGE MOTION IN HOMOGENEOUS MEDIUM. M. I. Ryazanov (Moscow Inst. of Engineering Physics). Zh. Eksperim. i Teor. Fiz., 43: 1559-61(Oct. 1962). (In Russian)

Vavilov-Cherenkov emission is impossible in a case in which a charge moves uniformly with velocity $\underline{v}$ in a dielectric medium with penetrability $\epsilon(\omega)$ such that the disparity $v^2\epsilon(\omega) < 1(\hbar = c = 1)$ is satisfied. It is shown that under identical conditions in a tangible media a uniformly moving charge can have another type of emission (combined emission) based on combined scattering in which the quantum frequency changes due to atomic transition. The combined emission of a uniformly moving charge can be utilized for super-high-energy particle detection by the angle of photon emission at a given frequency. The probability of combined emission is determined by the excited state properties. A case of combined emission, where ΔE coincides with one of the atomic frequencies $T \ll \Delta E$ and $\Delta E \ll \omega \ll m_e$, is analyzed. (R.V.J.)

7039 SEARCH FOR RESONANCE IN $K^0\overline{K}^0$ PAIR PRODUCTION. V. V. Barman, Yu. S. Krestnikov, E. V. Kuznetsov, A. G. Meshkovskii, and V. A. Shebanov (Inst. of Theoretical and Experimental Physics, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1564-5(Oct. 1962). (In Russian)

Studies of $K^0\overline{K}^0$ pair production by π^- mesons with 2.8 Bev/c momentum in freon and xenon bubble chambers $(\pi^- + (A,Z) \rightarrow K^0 + \overline{K}^0 + (A,Z)^* + n\pi,\ n = 0,1,2\ \ldots)$ resulted in 38 production events in freon and 13 in xenon. A diagram of pair distribution according to effective mass was constructed in order to determine the presence of possible resonances. The results indicated a probability of resonance in the K^0-$\overline{K}^0$ system at 1275 Mev and in the $\overline{K}$-n system at 1715 Mev. (R.V.J.)

7040 INELASTIC NUCLEON-NUCLEON INTERACTIONS. I. A. Kuchin and P. A. Usik (Inst. of Nuclear

Physics, Academy of Sciences, Kazakh SSR). Zh. Eksperim. i Teor. Fiz., 43: 1569-74(Nov. 1962). (In Russian)

In the single-meson approximation interactions between two nucleons are considered for which (a) only one nucleon is excited and (b) both nucleons are not excited (process proceeds via $\pi\pi$ interaction). The magnitude and asymptotic behavior of the cross sections of such processes are estimated. It is found that the asymmetry in the angular distribution of secondary protons in pn interactions at 9 Bev may be due to processes of the type considered above. (auth)

7041 TRIPLE SCATTERING OF 660 Mev PROTONS. III. ANGULAR DEPENDENCE OF PARAMETER R. Yu. P. Kumekin, M. G. Mescheryakov, S. B. Nurushev, and G. D. Stoletov (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1665-71(Nov. 1962). (In Russian)

In accordance with the program of reconstructing the pp scattering matrix at 660 Mev, further experiments on triple scattering of protons have been carried out. The experimental arrangement is described and results of measurement of the parameter R at angles 54, 72, 90, 108, and 126° in the cms are presented. The results are interpreted in terms of the pp scattering matrix amplitudes. Values of the moduli and relative phase angles of the matrix elements are found for the angle 90°. (auth)

7042 INVESTIGATION OF FOUR-FERMION INTERACTION BY MEANS OF UNITARITY AND ANALYTICITY. Yu. A. Simonov. Zh. Eksperim. i Teor. Fiz., 43: 1678-83 (Nov. 1962). (In Russian)

Equations have been written for contact four-fermion interaction that follow from unitarity and analyticity. They are used to investigate the asymptotic behavior of fermion-fermion and antifermion-fermion scattering amplitudes at high energies. It is shown that if one assumes a power dependence of the amplitudes upon energy, no contradictions arise in the equations, in contrast to perturbation theory. A connection has been found between the orders of growth n_j of various amplitudes and the limits that confine the magnitude of n_j from above and below. (auth)

7043 ON RESONANCE INTERACTIONS OF K-MESONS. Ya. I. Granovskii and A. A. Pantyushin (Inst. of Nuclear Physics, Academy of Sciences, Kazakh SSR). Zh. Eksperim. i Teor. Fiz., 43: 1684-7(Nov. 1962). (In Russian)

Effects in the physics of strange particles due to resonance $K\pi$ interaction (K^* meson) are considered. It is shown that in a number of cases this interaction determines the main features of the observed phenomena. (auth)

7044 ELECTRON-PHOTON SHOWERS PRODUCED BY HIGH ENERGY μ-MESONS. E. V. Gedalin (Inst of Physics, Academy of Sciences, Georgian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1697-1700(Nov. 1962). (In Russian)

Integral spectra of shower electrons and photons in thick absorbers are calculated by taking into account direct formation of electron-positron pairs and bremsstrahlung radiation by high energy μ mesons. (auth)

7045 POSSIBLE ROLE OF VECTOR MESONS IN ELASTIC SCATTERING OF HIGH ENERGY π-MESONS AND PROTONS. G. G. Arushanov (Inst. of Physics and Tech., Academy of Sciences, Uzbek SSR). Zh. Eksperim. i Teor. Fiz., 43: 1709-11(Nov. 1962). (In Russian)

The contribution of a pole diagram due to vector particle exchange to elastic scattering of π mesons and protons on protons and also of π mesons on π mesons at high energies is calculated. Good agreement with the experiments is obtained. (auth)

7046 DEPOLARIZATION OF μ^+-MESONS IN SOLIDS. V. G. Nosov and I. V. Yakovleva. Zh. Eksperim. i Teor. Fiz., 43: 1750-64(Nov. 1962). (In Russian)

A theory is developed of depolarization of μ^+ mesons in matter, taking into account the presence of an external magnetic field. The importance is shown, for the process under consideration, of chemical reactions involving the μ^+ mesons. On the basis of experimental data on depolarization of μ^+ mesons in emulsions, parameters are determined that enter into the formulas of phenomenological theory, and the asymptotic trend of polarization in large fields is predicted. Certain possible mechanisms of the depolarization of an electron of muonium are discussed and the effect produced by them is evaluated. The case of media with high dielectric constant and slight frequency dispersion is considered. (auth)

7047 RADIATIVE CAPTURE OF μ^--MESON BY A PROTON. G. A. Lobov and I. S. Shapiro (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1821-5(Nov. 1962). (In Russian)

Radiative capture of a μ^- meson by a proton is considered anew. The analysis of the contributions from induced pseudoscalar interaction not only takes into account diagrams in which a photon is emitted by a μ^- meson but also diagrams in which photons are emitted by protons and virtual π^+ mesons. If the pseudoscalar constant $g_P = +8g_A$ and the indicated diagrams are taken into account, the probability for radiative capture of a μ^- meson by a proton is about twice that computed by Bernstein. A change in sign of the pseudoscalar constant changes the radiative capture probability by 2.5 times. A relation between μ^- meson radiative capture due to induced pseudoscalar interaction and the photoproduction of π^- mesons on neutrons ($n + \gamma \rightarrow \pi^- + p$) and radiative decay of the π^+ meson ($\pi^+ \rightarrow \mu^+ + \nu + \gamma$) is obtained. (auth)

7048 ON A CERTAIN EXPERIMENTAL POSSIBILITY OF VERIFYING HYPOTHESES REGARDING THE NATURE OF RESONANCES. B. V. Geshkenbein and B. L. Ioffe (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1841-2(Nov. 1962). (In Russian)

It is pointed out that from the magnitude of the mass difference between the isotopic components of a resonance level it can be determined whether a given resonance is a bound state of a pair of particles or a resonance level of the Breit-Wigner type in a system of other particles. (auth)

7049 ON GRAVITATIONAL INTERACTION OF FERMIONS. I. Yu. Kobzarev and L. B. Okun (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1904-9(Nov. 1962). (In Russian)

Gravitational interaction of spin $\frac{1}{2}$ particles is considered in the linear approximation. It is shown that if gravitational interaction is taken into account, the question whether a free neutrino is two- or four-component acquires a physical meaning. The vertex part for the interaction between fermions and the gravitational field is shown to possess properties which are analogous to those of the electrodynamic vertex described by the Ward theorem. Observable effects due to spins are considered. (auth)

7050 SCATTERING OF ELECTRONS ON PROTONS WITH ACCOUNT OF DIPOLE MOMENTS. A. A. Bogush and I. S. Satsunkevich (Belorussian State Univ., USSR). Zh. Eksperim. i Teor. Fiz., 43: 1953-6(Nov. 1962). (In Russian)

The differential cross section for scattering of electrons on protons which possess a dipole structure is

derived by a direct calculation of the matrix elements, initial and final longitudinal polarizations of the particles being taken into account. The cross section correction calculated under the assumption that the proton has dipole moments (electric and magnetic) may be invoked for explaining the discrepancy between the experiments and generally accepted phenomenological model of the process. (auth)

7051 ON PHOTOPRODUCTION OF STRANGE PARTICLES. V. M. Arythyunyan (Inst. of Physics, Academy of Sciences, Armenian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1964-6(Nov. 1962). (In Russian)

Photoproduction of Λ^0K^+ near the threshold is considered in the K^+ particle exchange approximation. The result is compared with experiments. Agreement is observed for a relative parity in the ΛK^+p-vertex $P_{\Lambda p} = -1$. (auth)

7052 ELECTROMAGNETIC WAVES. Proceedings of a Symposium Conducted by the Mathematics Research Center, United States Army, at the University of Wisconsin, Madison, April 10-12, 1961. Rudolph E. Langer, ed. Madison, Wisconsin, University of Wisconsin Press, 1962. 403p. $6.00.

Studies are presented of electromagnetic theory and geometrical optics, diffraction and scattering, interactions of dipoles with media, radar, beams, antennae, and wave propagation. (T.F.H.)

7053 QUANTUM THEORY OF SCATTERING. Ta-You Wu and Takashi Ohmura. Englewood Cliffs, N. J., Prentice-Hall, Inc. Publishers, 1962. 513p. $16.00.

The theory of scattering is reviewed, beginning with variational, partial-wave, integral, and approximational analyses of scattering by central fields. Attention is devoted to scattering by non-central fields, composite-particle interactions and nuclear reactions, the time-dependent theory, S- and R-matrix theories, and dispersion relations. Discussions are presented of Green's function, the Bohr compound-nucleus theory, nucleon polarization in scattering, and other topics. (T.F.H.)

Neutron Physics

7054 (AEEW-R-118) APPROXIMATE FORMULAE FOR THE CALCULATION OF EFFECTIVE RESONANCE INTEGRALS IN THE STATISTICAL REGION. A. Reichel (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Aug. 1962. 32p.

Approximate formulae are given for calculating values of the function $J(\xi, \beta)$ averaged over the Porter-Thomas distribution of reduced neutron widths, so that effective resonance integrals can be calculated in the statistical region. A method of error correction is suggested. In the case of infinitely dilute resonance integrals, averaging over the Porter-Thomas distribution and integration over energy can be carried out explicitly, if it is assumed that in the statistical region resonances have a uniform spacing equal to the mean of the statistical distribution of spacing. (auth)

7055 (HW-SA-2415) NEUTRON RETHERMALIZATION IN GRAPHITE AND WATER. R. A. Bennett (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Mar. 20, 1962]. Contract AT(45-1)-1350. 56p.

Spatial distributions of radioactivities of Cu^{64} and Lu^{177} induced by thermal neutrons near temperature discontinuities in graphite and in graphite and water systems have been analyzed with a multithermal-group diffusion model of the space-energy distribution of the thermal neutrons. Rethermalization cross sections for graphite and water have been inferred from the Cu^{64} data. For graphite at a physical temperature of 300°K, the cross sections vary from 0.009 to 0.069 cm^{-1} for neutron spectra with characteristic temperatures in the range from 144 to 828°K, respectively. For graphite at physical temperatures in the range from 144 to 828°K, the cross sections vary from 0.016 to 0.044 cm^{-1} respectively for a neutron spectrum with a characteristic temperature of approximately 300°K. For water at a physical temperature of approximately 300°K, the cross sections vary from 1.25 to 0.75 cm^{-1} for neutron spectra characterized by temperatures in the range from 410 to 720°K, respectively. Calculated traverses of the thermal activities of Lu^{177}, which were made with the multithermal-group model using those rethermalization cross sections, agree to within ±10% with the observed traverses. Effective masses of graphite inferred from the cross sections agree to within ±20% with those obtained from differential measurements of the energy distributions of neutrons from the graphite of a graphite-uranium lattice. Relaxation lengths, also inferred from the cross sections, agree to within 30% with those calculated from the results of a theoretical investigation of elastic and one phonon inelastic scattering of hot neutrons in 300°K graphite. (auth)

7056 (HW-SA-2696) COLLISION PROBABILITIES IN SPHERES WITH ARBITRARY RADIAL SOURCE DISTRIBUTION. Paul F. Gast (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 19, 1962. Contract AT(45-1)-1350. 17p.

First-flight collision probabilities in spheres where the source density is uniform were presented by Case, et al. A method was developed for obtaining such probabilities when the source density varies radially. Tables of probalities were computed. When the source is proportional to sin Br/Br, the collision probability, P_c, in a sphere of radius R is given by: $P_c = (\Sigma R/BR) \arctan (BR/\Sigma R) - [(BR)^3(\Sigma R)/\tan BR\text{-}BR]\, G_3(BR, \Sigma R) - [(BR)^2(\Sigma R) \tan BR/\tan BR\text{-}BR]\, G_2(BR, \Sigma R)$ where: $G_n(a,y) = \int_y^\infty (e^{-x}(x \cosh x - \sinh x)/(a^2 + x^2)x^n)$. Direct numerical evaluation of the expression for P_c proved convenient and a program to do this on the IBM-7090 was prepared. Results with a normal mode source for several extrapolated end points are presented in tabular form. More detailed tables are included. Probabilities for any source distribution which is Fourier expandable can be obtained from the expression: $P_c = (\Sigma A_i P_{ci}/\Sigma A_i)$ where A_i is the i'th expansion coefficient and P_{ci} is the corresponding collision probability. Tables of P_{ci} are available for the higher harmonics. (auth)

7057 (TID-14262) STRATEGY FOR MULTIDIMENSIONAL NEUTRON GROUP DIFFUSION COMPUTATIONS. Eugene L. Wachspress (Knolls Atomic Power Lab., Schenectady, N. Y.). Nov. 6, 1961. Contract [W-31-109-eng-52]. 10p.

In nuclear reactor design computations, one often solves the neutron group diffusion differential equations in two and three space dimensions. Finite difference techniques are used to reduce these differential equations to large systems of simultaneous linear equations. The basic statics problem is that of finding the fundamental neutron flux mode and its eigenvalue. Two distinct iterations are performed simultaneously, one on the fission neutron source (outer iteration) and the other on group fluxes (inner iteration) corresponding to a fixed fission source. Successive overrelaxation or alternating-direction-implicit iteration is used for the inner iteration. Chebyshev extrapolation or Wielandt's fractional iteration is

used to accelerate convergence of the outer iteration. Theoretical optimization of iteration parameters is possible for certain model problems, and such analysis guides strategy for more complex situations. Wielandt's method enhances outer iteration convergence at the expense of inner iteration convergence to give a net increase in computer time when successive over-relaxation is used for the inner iteration. On the other hand, Wielandt's method, together with alternating-direction-implicit inner iteration, can lead to a significant reduction in computation time. (auth)

7058 (TID-15165) MEASUREMENT OF DIFFUSION COEFFICIENT FOR THERMAL NEUTRONS IN D_2O BETWEEN 20°C AND 220°C. Norman P. Baumann (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [Mar. 1962]. Contract AT(07-2)-1. 21p.

The diffusion coefficients for thermal neutrons in D_2O were measured at temperatures of 20, 100, 165, and 220°C. The technique involved measurement of the change in neutron relaxation length with the addition, at each temperature, of known amounts of neutron poison in the form of copper tubing. Measurements were made at an isotopic purity of 99.30 mol % D_2O. After corrections were made for D_2O purity and neutron spectrum shifts, good agreement was obtained with calculated values. The final values of the diffusion coefficient were 0.841 ± 0.010, 0.912 ± 0.011, 0.989 ± 0.012, and 1.091 ± 0.013 cm, respectively, for 20, 100, 165, and 220°C. (auth)

7059 STATISTICAL THEORY OF NEUTRON CHAIN REACTIONS. [PART] I. L. Pál. Acta Phys. Acad. Sci. Hung., 14: 345-55(1962). (In Hungarian)

A statistical theory is developed for the chain reactions occurring in nuclear reactors. The probability distribution function for the number of neutrons in a given state is derived with assumptions of quite general character. From the distribution function the fundamental equation of the generating function is obtained allowing the calculation of the expectation value and the variance of the neutron population. (auth)

7060 STATISTICAL THEORY OF NEUTRON CHAIN REACTIONS. [PART] II. L. Pál. Acta Phys. Acad. Sci. Hung., 14: 357-67(1962). (In Hungarian)

Using a statistical method equations are derived for the probability distribution functions of the number of fissions and neutrons counted during a given time. Since the expectation value and the variance are important for practical purposes, equations are given for both quantities for each of the cases investigated. The multi-group approximation is introduced into the framework of the statistical theory of neutron chain reactions. (auth)

7061 STATISTICAL THEORY OF NEUTRON CHAIN REACTIONS. [PART] III. L. Pál. Acta Acad. Sci. Hung., 14: 369-80(1962). (In Hungarian)

The statistical theory of neutron chain reactions is applied to the determination of the prompt neutron lifetime and the effective delayed neutron fraction. The effects of delayed neutrons and correlation between the numbers of neutrons counted in consecutive time intervals are studied as sources of error in Feynman's method. The possibility of a more accurate foundation of the method proposed by Magilner is indicated. (auth)

7062 NEUTRON FLUX DISTRIBUTIONS IN CYLINDERS BY A VARIATIONAL METHOD. C. D. McKay (Royal Military Coll. of Canada, Kingston, Ont.). Can. J. Phys., 40: 1714-29(Dec. 1962).

A variational method in which the trial functions are linear combinations of a finite set of simple basic functions is considered as a means of obtaining simple and accurate approximations to the flux distributions in homogeneous circular cylinders, which range from purely capturing to purely scattering. In particular, analytic formulae and some numerical results are given for basic functions that are even powers of the distance from the cylinder axis, and some formulae are given for trial functions composed of square-pulse functions. It is found that even though the trial function with the parameters determined by the variational principle is not itself a particularly good approximation to the exact flux distribution, it may often be easily iterated in the integral equation to give a satisfactory approximation. The trial function may also be used to evaluate integrals of the flux times arbitrary weighting functions, with results equivalent to those given by complex variational methods that require the introduction of an auxiliary equation. (auth)

7063 NEUTRON FLUX. J. Montes Ponce de Leon and Enriquez de Salamonca Lorente (Junta de Energia Nuclear, Madrid). Energia Nucl. (Madrid), 6: 24-31(Apr.-June 1962). (In Spanish)

The concept of neutron flux includes a factor that corresponds to the neutron density and another that corresponds to the neutron velocity. The concept of neutron flux, the factors that must be taken into consideration in measuring flux, and the relation between the measurements and the flux are described. (J.S.R.)

7064 MEASUREMENT OF THE POLARIZATION CAPACITY OF OXYGEN FOR (d,d) NEUTRONS OF 2.5-3.2 Mev ENERGY. P. Huber, J. Durisch, R. Gleyvod, and E. Baumgartner (Universität, Basel). Helv. Phys. Acta, 35: 292-3(1962). (In German)

Deuterium ions were accelerated and led to a heavy ice target. The polarized neutrons produced were scattered on liquid oxygen and the azimuthal asymmetry was measured with proportional counters. A paraffin shield was used to reduce the background. The measurement results are tabulated with all values being corrected for double scattering. (J.S.R.)

7065 MEASUREMENT OF THE POLARIZATION CAPACITY OF COPPER AND ZIRCONIUM FOR (d,d) NEUTRONS AT 3.4 Mev. E. Baumgartner, J. Durisch, R. Gleyvod, and P. Huber (Universität, Basel). Helv. Phys. Acta, 35: 293-4(1962). (In German)

The polarization capacity of copper and zirconium were measured at neutron energies of 3.16 Mev as a function of the scattering angle. The results, which are corrected for double scattering, are tabulated. Theoretical results previously reported are in good agreement with the experimental values. (J.S.R.)

7066 MEASUREMENT OF THE POLARIZATION OF NEUTRONS FROM THE (d,T) REACTION WITH POLARIZED DEUTERONS. H. R. Striebel, F. Seiler, W. Haeberli, E. Baumgartner, and P. Huber (Universität, Basel). Helv. Phys. Acta, 35: 294-5(1962). (In German)

Experiments on $T(d,n)He^4$ reactions with polarized deuterons were carried out to measure the transverse polarization of neutrons emitted at <90° with respect to the flight direction of the deuterons. The tensor polarization of the deuteron beam was measured, and the azimuth independence of the neutron emission at 90° was proved. The neutron polarization was detected by scattering on He^4. The degree of transverse neutron polarization was $P_1^n = 0.210 \pm 0.026$, which corresponds to a vector polarization of the incident deuteron beam of $P_3^{(d)} = 0.199 \pm 0.025$. The component of the tensor polarization of the deuteron beam was $P_{33} = -0.204 \pm 0.001$. The results are in satisfactory agreement with expected source behavior. (J.S.R.)

7067 MEASUREMENT OF THE EFFICIENCIES OF DETECTOR SHIELDING FOR NEUTRONS AT 14 Mev. B. Vaucher, J. C. Alder, G. A. Grin, C. Joseph, and J. F. Loude (Laboratoire de Recherches Nucléaires E.P.U.L., Lausanne, Switzerland). Helv. Phys. Acta, 35: 300-4 (1962). (In French)

In time-of-flight studies of fast neutron scattering, it is necessary, in order to decrease the rate of chance coincidences, to shield the neutron detector. The efficiencies of various thicknesses of paraffin, iron, and lead as neutron shields were determined, and the results were shown graphically. It was established that the neutron counting rates tend toward the same saturation value for the three materials. The γ coincidence rates show the production of γ particles by inelastic scattering in the shield. The effective relaxation lengths for 14.1-Mev neutrons were calculated. (J.S.R.)

7068 NEUTRONS AND PHONONS. Robert M. Brugger. Intern. Sci. Technol., No. 11, 52-9(Nov. 1962).

In experiments to date the source of neutrons has been a nuclear reactor. Neutrons in a narrow band of energies are selected either by diffraction from a particular set of planes in a single crystal or by passing the reactor beam through a pair of "choppers" rotating at the same rate but slightly out of phase so that only neutrons of a specified energy can pass. These monoenergetic neutrons are inelastically scattered from a sample, and the energies of the scattered neutrons are analyzed either by diffracting them from yet another set of planes in yet another crystal or by measuring electronically their time of flight over the fixed distance from the sample to a detector. The technique is expensive and complex, but the results are already forcing refinement of theoretical models of lattice dynamics and promising much deeper understanding of the internal dynamics of solids. (W.D.M.)

7069 SEALED-OFF NEUTRON TUBE: THE UNDERLYING RESEARCH WORK. O. Reifenschweiler. Philips Res. Rept., 16: 401-18(Oct. 1961). (In English)

Investigations into the making of sealed-off neutron tubes are reported. Neutron tubes are a kind of gas-discharge tube, having roughly the same size and operating voltages as x-ray tubes and designed for the generation of neutrons. The ions produced in a Penning ion source (deuterons or a mixture of deuterons and tritons are used) are accelerated by a single-stage accelerating system to potentials between 100 and 200 kv. They strike a tritium target, where they liberate neutrons of 14 Mev. In addition to the conventional tritium target, the system incorporates a supplementary target. A special device keeps the gas pressure constant during the operation of the tube. The neutron yield is better than 10^8 neutrons per second. The structural elements of the tube and the problems they involve are discussed. (auth)

7070 SCATTERING OF SLOW NEUTRONS IN SOLIDS. Giuseppe Caglioti (Comitato Nazionale Energia Nucleare, [Milan]). Rend. Seminario Mat. Fis. Milano, 32: 18p.(1962). (RT/FI(62)42). (In Italian)

Basic principles underlying the techniques of low-energy-neutron diffraction and inelastic scattering by solids is presented. An account of experimental apparatus suitable for this kind of work is given. Reference is made to the crystal spectrometer in operation at the Ispra-1 reactor. Some neutron diffraction patterns are shown. Only coherent scattering is discussed, and, for the sake of simplicity, the diffraction of neutrons by a solid is treated as an essentially elastic process. (auth)

7071 EFFECT OF TEMPERATURE GRADIENTS ON THE DIFFUSION OF THERMAL NEUTRONS. M. E. Foglio (Instituto de Física, Bariloche, Argentina). Rev. Union Mat. Arg., 19: 303-25(1962). (In English)

The effect of thermal gradients on the diffusion of thermal neutrons in solid media was obtained, assuming (i) classical scattering of neutrons by nuclei and (ii) particular distribution function for the velocity of nuclei. A correction, linear in grad T, is obtained. Quantum effects were not taken into account. Thus the better the agreement of the scattering law used with the actual one, the better the results obtained will hold. (auth)

7072 INFLUENCE OF SPIN-SPIN INTERACTION ON NEUTRON SCATTERING IN PARAMAGNETIC MATERIALS. B. M. Khabibullin (Physics Inst., Kazan Branch, Academy of Sciences, USSR). Soviet Phys.-Solid State (English Transl.), 4: 1339-43(Jan. 1963).

Based on certain special assumptions, the influence of phonon-induced spin-spin interaction on the energy spectrum of neutrons scattered in a paramagnet is discussed. The scattering curves experience a shift which, in order of magnitude, is equal to the shift due to relaxation effects. (auth)

7073 SLOW NEUTRON SCATTERING BY THE SPIN SYSTEM OF A PARAMAGNETIC MATERIAL. B. M. Khabibullin (Kazan Branch, Academy of Sciences, USSR). Soviet Phys.-Solid State (English Trans.), 4: 1449-50(Jan. 1963).

In a previous discussion of the inelastic scattering of slow neutrons by phonons in a paramagnetic crystal resulting from magnetic interaction of the spin system was discussed. The value found for the cross section was 10^{-26} to 10^{-27} cm^2. The scattering mechanism is considered. (W.D.M.)

7074 ON THEORY OF SCATTERING OF NEUTRONS BY THE COULOMB FIELD OF THE NUCLEUS. S. B. Gerasimov, A. I. Lebedev, and V. A. Petrunkin (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1872-9(Nov. 1962). (In Russian)

The role of some electrodynamic effects in the scattering of neutrons on the Coulomb field of nuclei is analyzed. Scattering of neutrons is considered in the first and second approximations of perturbation theory by taking into account the neutron electric form factor and contact interaction between the neutron and nucleus. The possible role of diagrams of the sixth order in $\underline{e}$ which contain the block of photon scattering on the nuclear Coulomb field is discussed. Upper limits are estimated for the proton and neutron polarizabilities connected with nonlinear electrodynamic effects. It is demonstrated that the deviations from the Schwinger formula for scattering of a moving magnetic moment in a nuclear Coulomb field may be important for determining the meson polarizability of the neutron in scattering experiments. (auth)

Nuclear Properties and Reactions

7075 (AROD-2577:2) SEARCH FOR SPIN-ZERO STATES IN EVEN-EVEN NUCLEI. Final Report, November 1, 1959–October 31, 1962. Walter E. Meyerhof (Stanford Univ., Calif.). Contract DA-04-200-ORD-1029. 15p. (AD-290359)

Inelastic neutron scattering near threshold, used to determine selectively 0^+ excited states, is useful to distinguish between nuclear models currently used to describe the properties of even-even nuclei. During the course of

the work it was found that not only inelastic, but also elastic neutron scattering might serve to determine spins of inelastically excited states. The reason for this is that the possibility of inelastic excitation affects the wave function for the elastic scattering process. The effect on the elastic scattering cross section can have under certain conditions, the shape of a cusp, and is called "Wigner cusp." A theoretical analysis of the Wigner cusp phenomenon showed that, in principle, Wigner cusps can also determine the reaction mechanism, that is whether it proceeds via compound nucleus formation or direct interaction or partially via both. (auth)

7076 (BNL-5801) NOTE ON THE THEORY OF ELECTRON SCATTERING BY MOLECULES: THE EFFECTS OF NEGATIVE-ION STATES. Joseph C. Y. Chen (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT-30-2-GEN-16]. 12p.

The effects of negative-ion states on the theory of electron scattering by molecules (or atoms) are discussed. It is shown that these effects, under the independent particle approximation, arise from the configuration interaction involving negative-ion states. Application to the excitation of molecular vibration by subexcitation electron impact yields non-vanishing matrix elements which can be used to calculate the cross section for such vibrational excitation. The differences between this approach and the second order perturbation approach are discussed in some detail. (auth)

7077 (EANDC(E)-37L) BACKGROUND FOR THE COMBINED GERMAN-FRENCH PRIORITY I REQUEST FOR σ_{nf}(Pu 240) MEASUREMENTS. J. J. Schmidt (Kernforschungszentrum, Karlsruhe, Germany). July 18, 1962. 6p.

It is noted that in fast reactors with high burnup the buildup of Pu^{240} apparently would lead to a useful reactivity gain if it has an appreciable subthreshold of fission. Earlier experimental work on the probability for subthreshold fission is not in agreement; however, it is thought worthwhile to investigate the low kev region. (J.R.D.)

7078 (IEA-51) SECCÕES DE CHOQUE PARA NEUTRONS DO PRASEODÍMIO, ITÉRBIO E LUTÉCIO. (Neutron Cross Sections of Praseodymium, Ytterbium, and Lutetium). Robert Zimmerman, Oliver Martins, Manuel de Abreu and Marieta de Camargo Mattos (Brazil. Instituto de Energia Atômica, Sao Paulo). June 1962. 33p.

The total cross section was measured for the oxides of Pr, Yb, and Lu for neutron energies from 0.015 to 0.3 ev. For these measurements, a neutron monochromator with natural calcite crystal was used in the I.E.A. reactor. The purity of Pr was verified experimentally, and the agreement of the results indicates that the oxide samples used contain very low quantities of Gd and Sm. The correction of the cross sections, necessitated by the presence of second order reflections of the crystal, was done experimentally using the known cross section for gold. A nuclear resonance was found for Lu within the interval studied. The parameters found for this resonance coincides with the published values, but with a better approximation. Calculations with the Breit-Wigner formula for this resonance in Lu and for the cross section of Pr show that no bound state, in the vicinity, is necessary to explain the magnitude and form of the experimental results. Proof of a bound state exists in the case of Yb. (tr-auth)

7079 (IS-272) INTERNAL CONVERSION COEFFICIENTS OF THE $2^+ - 0^+$, E2 TRANSITIONS IN EVEN-EVEN Sm^{152} AND Gd^{158}. D. C. Lu and G. Schupp (Ames Lab., Ames, Iowa). [Mar. 3, 1961]. Contract [W-7405-eng-82]. 26p.

To investigate the deviation of the internal conversion coefficients of E2 transitions from theoretical computations and their dependence on nuclear deformation, the total internal conversion coefficient of the 121.8-kev $2^+ - 0^+$ transition in ellipsoidal Sm^{152} was measured to be 1.135 ± 0.010 with a high accuracy coincidence-sum method. The K-shell to total internal conversion ratio was determined to be 0.588 ± 0.003 with a β spectrometer. The K-, L- and M-shell internal conversion coefficients were deduced as: $\alpha K = 0.667 \pm 0.008$, $\alpha L1 = 0.070 \pm 0.003$, $\alpha L2 = 0.155 \pm 0.005$, $\alpha L3 = 0.151 \pm 0.006$, $\alpha M1 = 0.011 \pm 0.001$, $\alpha M2 = 0.037 \pm 0.003$, and $\alpha M3 = 0.036 \pm 0.005$. The αK of the 344-kev $2^+ - 0^+$ transition in near spherical Gd^{152} was determined to be $(2.84 \pm 0.07) \times 10^{-2}$ by β-conversion electron coincidence method using two β spectrometers end to end. The experiment revealed no deviation from theory nor indications of strong dependence on nuclear deformation; it therefore did not confirm recent beliefs in this regard. The details of the coincidence-sum method were described. The K electron to total electron capture ratio from Eu^{152} to the 1.53 Mev state in Sm^{152} was also measured to be 0.79 ± 0.02. (auth)

7080 (JINR-P-1024) AMPLITUDY NUKLON-NUKLONNOGO RASSEYANIYA I KOMPLEKSNOST SPIN-ORBITAL'NOGO POTENTSIALA VZAIMODEISTVIYA NUKLONOV S YADRAMI. (Amplitudes of Nucleon-Nucleon Scattering and Complexity of the Spin-Orbit Potential in the Interaction Between Nucleons and Nuclei). L. S. Azhgirei, Yu. P. Kumekin, M. G. Meshcheryakov, S. B. Nurushev, and G. D. Stoletov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 8p.

Relations for nucleon-nucleon and nucleon-nucleus scattering amplitudes, represented by a superimposed model, are used for determining the averaged isotopic spin amplitudes of forward nucleon-nucleus scattering at 660 Mev. The correlation of experimental data for nucleon-nucleon scattering with phase analyses showed that the spin-orbit potential on nucleon-nucleus interactions is complex at 40 to 660 Mev. (tr-auth)

7081 (JINR-P-1025) UPRUGOE RASSEYANIE NA MALYE UGLY PROTONOV YADRAMI UGLERODA PRI 660 Mev. (Elastic Scattering of Protons Within a Small Angular Range by Carbon Nuclei at an Energy Level of 660 Mev). L. S. Azhgirei, Yu. P. Kumekin, M. G. Meshcheryakov, S. B. Nurushev, G. D. Stoletov, and Tieh-tsiang Huang (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 20p.

Differential cross sections for elastic scattering of protons by carbon at 660 Mev were measured at angle of $1.8° \leq \Theta \leq 9°$. The elastic proton scattering was separated from inelastic processes by magnetic analysis, and the following magnitudes were obtained for spin-free and spin scattering amplitudes: $g_{NR}(0) = -5.05 \pm 0.45$, $g_{NI}(0) = 15 \pm 0.45$; $b_{NR}(0) = -10.4 \pm 13.3$, $b_{NI}(0) = 37.6 \pm 9.3$ (in units of 10^{-13} cm). Evaluations were made of integrated potentials for optical models, and it is shown that the intensity of spin-orbit interaction diminishes with energy. The complexity of spin-orbit potential in nucleon-nucleus interactions at 660 Mev was analyzed. (tr-auth)

7082 (JINR-P-1072) EKSPERIMENTY PO OBNARUZHENIYU PROTONNOI RADIOAKTIVNOSTI YADER. (Experiments for Determining Proton Emission by Nuclei). V. A. Kaphaykhov, G. M. Ter-Akopiyan, and V. G. Subbotin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Reactions). 1962. 11p.

An attempt was made to determine proton radioactivity

of nuclei. The experiments were carried out in a 300-cm cyclotron internal beam using Ni targets irradiated with Ne^{20} ions at 130 Mev. Two proportional counter telescopes were used for recording nuclear decays. The obtained data indicate proton emission from decaying radioactive nuclei. (tr-auth)

7083 (JINR-P-1081) POGLOSHCHENIE π^- MESONOV V VODORODOSODERZHASHCHIKH VESHCHESTVAKH. (Absorption of π^- Mesons in Hydrogenous Substances). V. I. Petrukhin and Yu. D. Prokoshkin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 9p.

A detailed study was made of π^- capture in hydrogenous substances, and the probability of π^- capture by hydrogen nuclei was determined as a function of the nuclear charge Z chemically bonded with hydrogen. The scheme of the experiment, made using a 75-Mev π^- beam and a series of scintillation counters and Cherenkov spectrometers is included. (R.V.J.)

7084 (LA-2763) HAFNIUM CROSS SECTIONS AND THEIR TEMPERATURE DEPENDENCE. Joseph J. Devaney, Leona O. Bordwell, and Marjorie J. Devaney (Los Alamos Scientific Lab., N. Mex.). July 1962. Contract W-7405-eng-36. 117p.

A Breit-Wigner analysis of the Hf isotopes is folded into a Maxwellian velocity distribution and summed with abundance weights to obtain total, scattering, and radiative capture cross sections for normal isotopic Hf versus neutron energy from 0.0253 to 114 ev and for Hf temperatures of 0.0253 to 1 ev. The revised method of calculation is summarized. (auth)

7085 (NP-12309) ISOTOPIC AND ISOTONIC YIELDS IN NUCLEAR FISSION. M. Talât-Erben and Binay Gueven (Turkey. Atomic Energy Commission. Cekmece Nuclear Research Center, Istanbul). 1962. 15p. (CNAM-2)

The curves for isotopic and isotonic fission yields were calculated and shown to be the Weierstrass transforms of the isobaric yield curve. The mass asymmetry of fission was associated with asymmetry in charge and in neutron contents. There were "forbidden" zones at $44 < Z < 48$ and at $64 < N < 78$, where formation probabilities are extremely low. The distribution of the number of neutrons of the fission fragments was much narrower than what would be expected on the basis of the variation ranges for Z and N. The ambiguity existing about whether the fragments of a pair are meant to complement before or after prompt neutron boil-off was removed, and Glendenin's treatment was confirmed. There were indications, which were in full agreement with the properties of Wahl's empirical Z_p function, that the proton closed shell contribution (if any) to the fine structure observed in the isobaric yield curve may be larger than the contribution of the neutron closed shell. The isotopic yields of the known nuclides were significantly smaller than the yields defined by the full theoretical curves for Z = 38, 39, 40, 41, 52, and 57, indicating that new isotopes of Sr, Y, Zr, Nb, Te, and Ia are still to be identified as primary fission products from the thermal neutron fission of U^{235}. (auth)

7086 (NP-12319) EXPERIMENTAL RESULTS ON THE NUCLEAR FISSION INDUCED BY 600 Mev PROTONS. G. Potenza, R. Rinzivillo, E. Sassi, G. Vanderhaeghe, and H. G. de Carvalho (Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas). 1962. 20p. (Notas de Física, Vol. IX, No. 14(p.235-53)).

The fission phenomena induced by protons of about 600 Mev were studied in several nuclei (U^{238}, Th^{232}, Bi^{209}, W^{184}, and natural silver) by means of loaded, low-sensitivity nuclear emulsions. A significant improvement was obtained in the knowledge of the relative cross-sections. The angular distributions for U and Th were studied with particular regard given to the "non-collinear" tracks. No sign of anisotropy was found. For non-collinear events, a possible correlation was sought between the angle formed by the two tracks and the angle between the line connecting the two track extremities and the direction of the incident beam. No correlation was found. These results agree only partially with those obtained by other authors. (auth)

7087 (NP-12330) PROCEEDINGS OF THE NUCLEAR PHYSICS SYMPOSIUM, 1962, MADRAS, FEBRUARY 28 – MARCH 2, 1962. (India. Dept. of Atomic Energy. Physics Advisory Committee. Bombay). 443p.

Sixty-six papers are included of which abstracts are given for forty-nine. Two have previously been abstracted. (D.C.W.)

7088 (NP-12330(p.1-14)) THE FIRST EXCITED STATES OF CLOSED SHELL NUCLEI. C. Bloch (France. Commissariat à l'Energie Atomique, Centre d'Études Nucléaires, Saclay).

A comparison and discussion of accuracy in calculating parity levels of excited nucleons using a wave function involving both the forward and backward propagation of a particle-hole pair rather than a function considering only forward propagation are given. Data for O^{16} and C^{12} are listed that indicate that the combination function gives slightly more accurate results. Similar reports have been obtained on Ca^{40}. (D.C.W.)

7089 (NP-12330(p.15-16)) BINDING ENERGY OF H^3 AND n-d SCATTERING LENGTHS WITH SEPARABLE FORCES. B. S. Bhakar, V. S. Bhasin, and A. N. Mitra (Delhi. Univ.).

A description of "scattering off the energy shell" in a 3-body system based on a potential approach is discussed. Tables display necessary information on the potentials in a 3-body system and show experimental results for two scattering lengths ($s = \frac{1}{2}$, $s = \frac{3}{2}$) in n-d scattering. Poor agreement for $s = \frac{3}{2}$ indicates that further study of tensor force effects on scattering lengths is needed. (D.C.W.)

7090 (NP-12330(p.17-21)) COULOMB ENERGY CALCULATIONS FOR LIGHT NUCLEI. P. C. Sood (Panjab Univ., Chandigarh, India).

A check on possible overestimation of Coulomb exchange leading to a failure of light nuclei to fit Cameron's formula is based on calculations made with diffuse-boundary independent-particle model wavefunctions with appropriate corrections. Contributions to total Coulomb energy of all protons from direct and exchange terms are calculated and compared with results from usual statistical models. Mirror nuclei O^{17} and F^{17} are studied, and the results of calculations with fitting exchange corrections are given. Exchange corrections derived from quantum mechanical calculations are smaller than those reached by uniform distribution models. (D.C.W.)

7091 (NP-12330(p.22-34)) DIRECT INTERACTIONS IN LOW ENERGY NUCLEAR REACTIONS. E. Kondaiah (Tata Inst. of Fundamental Research, Bombay).

Arguments are presented showing that weak interactions inside nuclei, associated with the shell model of the nucleus, do not rule out compound nucleus formation that Bohr based on the presence of strong interactions. Predictions for compound nucleus models are presented, known inconsistencies are discussed, and explanations are given for such failures. Direct interactions are considered to cause some of the failures, but assumptions are made that permit both direct interactions and compound nucleus for-

mation. Various types of direct interactions and ways to analyze their effects are discussed along with direct photonuclear reactions. (D.C.W.)

7092 (NP-12330(p.35-8)) STUDY OF Bi(γ,p) REACTION USING Li(p,γ) GAMMA RAYS. E. Kondaiah, B. Lal, and M. L. Jhingan (Tata Inst. of Fundamental Research, Bombay).

Analysis of protons produced by the $Bi^{209}(\gamma,p)$ reaction is performed using a nuclear emulsion detector. Angular and energy distributions of the protons are given, and the presence of deuterons is discussed. Angular distribution appears asymmetric about 90°. (D.C.W.)

7093 (NP-12330(p.39-45)) INTERACTION OF 14.8 Mev NEUTRONS WITH ALUMINIUM. R. K. Mohindra and H. S. Hans (Aligarh Muslim Univ., Aligarh, India).

Proton, neutron, and alpha spectra from aluminum interactions with 14.8 Mev neutrons are calculated using compound nucleus theory and volume direct interaction theory. Two level density formulas and Newton's shell dependent formula were used. Graphs give energy spectra for alphas, neutrons, and protons for the various formulas and reveal that Newton and Lang and LeCouteur give an unduly high (n,α) reaction value. (D.C.W.)

7094 (NP-12330(p.46-52)) (n,α) REACTIONS INDUCED BY 14-Mev NEUTRONS. B. Sen (Saha Inst. of Nuclear Physics, Calcutta).

Determination of the role of direct interaction processes in reactions is made by studying the angular distributions of alpha particles emitted in (n,α) reactions with phosphorus and indium. Neutrons are supplied by (d,t) reactions using a 250 kv deuteron accelerator. Direction and energy of alpha particles are measured using nuclear emulsion plates. Graphs display energy and angular distributions of the alpha particles. In phosphorus the compound nucleus accounts for the reaction mechanism, while indium shows interference in distribution not attributable to a compound nucleus process. Study of angular distributions from (n,α) reactions on CNO indicated the presence of direct interaction processes. (D.C.W.)

7095 (NP-12330(p.61-5)) TOTAL CROSS-SECTION MEASUREMENTS WITH 14-Mev NEUTRONS. B. Mitra (Bose Research Inst., Calcutta. Nuclear Physics Lab.).

Corrected values for σ_t result from the use of directional counters as fast neutron detectors instead of plastic scintillators. Correction is also made for in-scattering. Corrected values of σ_t for Al, Cu, and Pb are listed with earlier determinations for comparison. (D.C.W.)

7096 (NP-12330(p.66-70)) NON ELASTIC SCATTERING OF 14-Mev NEUTRONS. A. Chatterjee and A. M. Ghose (Bose Research Inst., Calcutta. Nuclear Physics Lab.).

A method for making corrections needed in correlating measured transmission with non-elastic cross sections of the absorber, without transport and elastic transport cross sections, is proposed and discussed. If feasible, the method would yield the non-elastic cross section from cross-sectional measurements at two bias settings. (D.C.W.)

7097 (NP-12330(p.71-8)) EMISSION OF ALPHA PARTICLES IN THE FISSION PROCESS. R. Ramanna, K. G. Nair, S. S. Kapoor, and K. N. Iyengar (Tata Inst. of Fundamental Research, Bombay).

Ternary fission of U^{238} induced by 14-Mev neutrons is studied using emulsion techniques. Graphs display angular distribution results for binary and ternary fission. Angular distribution for ternary fission shows a peak at 90° to the incident neutron direction, and there is a peak for the n-f distribution at 90°. (D.C.W.)

7098 (NP-12330(p.79-85)) ANGULAR CORRELATIONS OF FISSION FRAGMENTS AND PROMPT RADIATIONS IN THE THERMAL NEUTRON FISSION OF U^{235}. S. S. Kapoor, R. Ramanna, and P. N. Rama Rao (India. Atomic Energy Establishment, Trombay)

Determination of various quantities—time of emission of gamma rays, relative emission probabilities from light and heavy fragments, and anisotropy of emission in mass center systems—by angular correlation of fission fragments and prompt radiations provides a technique for studying deexcitation mechanisms and fission processes. Discussion on gamma and neutron emission effects is included. (D.C.W.)

7099 (NP-12330(p.86-94)) NEUTRON INELASTIC SCATTERING CROSS SECTIONS IN LEAD ISOTOPES. N. Nath and J. B. Gupta (Delhi. Univ.).

Theoretical calculations are made for the excitation cross sections of levels in Pb^{206}, Pb^{207}, and Pb^{208}, using neutron inelastic scattering. Theoretical values obtained are plotted along with earlier values, and the results are discussed. (D.C.W.)

7100 (NP-12330(p.95-6)) THERMAL NEUTRON ACTIVATION CROSS-SECTIONS FOR A FEW CASES. S. K. Mangal and P. S. Gill (Aligarh Muslim Univ., Aligarh, India).

Thermal neutron cross sections are determined from irradiation in a swimming pool reactor. Results obtained by making allowances for the various phenomena are presented in a table. (D.C.W.)

7101 (NP-12330(p.97-103)) CROSS-SECTION FOR THE PRODUCTION OF Nb^{92}, Nb^{95} AND Nb^{96} BY (n,p) REACTION IN MOLYBDENUM BY FISSION-NEUTRONS. K. P. Gopinathan (Tata Inst. of Fundamental Research, Bombay).

Cross sections for (n,p) threshold reactions yielding Nb^{92}, Nb^{95}, and Nb^{96} are determined using the $Mo^{92}(n,p)Nb^{92}$ reaction as the standard for (n,p) reactions of Mo^{95} and Mo^{96}. Measurements were made by an absolute method. Molybdic acid capsules are irradiated in the reactor core, and chemical separation yields the niobium. Cross section values accurate to about 10 per cent are given, and analysis yields a good fit only for the Mo^{92} data. (D.C.W.)

7102 (NP-12330(p.104-8)) C^{12}-EXCITED STATES FROM THE STUDY OF GAMMA RAYS FROM A Po–Be NEUTRON SOURCE. D. Iakshmana Sastry, B. Somalinga Sastry, and Swami Jnanaranda (Andhra Univ., Waltair, India).

The gamma spectrum of Po–Be was examined to determine peaks produced by emission of multiple neutron groups. A 4-Curie Po–Be source is used, and gamma energies are determined within about 2% accuracy. The spectrum is presented and shows 3.06 Mev and 4.4 Mev energy values in agreement with previous determinations. Other gamma rays are not in evidence. (D.C.W.)

7103 (NP-12330(p.109-18)) ISOTOPE SHIFTS AND INTERNAL CONVERSION. B. V. Thosar (Tata Inst. of Fundamental Research, Bombay).

A discussion is presented of volume effects in isotope shifts that yield information on nuclear charge distribution, compressibility of nuclear matter, and nuclear shape deformations. Patterns of variations of volume effects are tied to nuclear deformation. Information is also presented on the internal conversion process. (D.C.W.)

7104 (NP-12330(p.119-21)) COLLECTIVE VIBRATIONS IN EVEN-EVEN NUCLEI WITH $A \approx 30$. V. K. Thankappan (Physical Research Lab., Ahmedabad, India).

Calculations based on the unified model are presented

for the energy levels of Si^{30} taking into account nucleonic phenomena for the last two neutrons. Level patterns are shown for the values used as well as observed levels of Si^{30} and P^{30} isotopic spin triplet states. Good agreement for a quantum energy of 2.5 Mev appears. (D.C.W.)

7105 (NP-12330(p.122-5)) NUCLEAR INTERACTION IN T = 1 $p^{1/2}$-DOUBLETS. Y. R. Waghmare (Physical Research Lab., Ahmedabad, India).

Analysis of doublets arising from certain excitation state configurations is made for various isotopes (C^{14}, Zr^{90}, Pb^{206}) by careful consideration of parameters used. A form for a two-body nuclear interaction that gives general agreement for $p^{1/2}$ doublets is given, and doublets for certain configurations are listed. (D.C.W.)

7106 (NP-12330(p.132-6)) BETA-GAMMA DIRECTIONAL CORRELATION IN Eu^{154}. S. K. Bhattacherjee and S. K. Mitra (Tata Inst. of Fundamental Research, Bombay).

The determination of the impact of various matrix elements on non-unique first forbidden beta transitions led to an examination of beta-gamma directional correlation. The correlation was measured using a plastic scintillator counter; the differential correlation was done with a ten-channel analyzer. Results are given and evaluated by Kotani's expression for ϵ. The modified B_{ij} approximation is found acceptable for the non-unique first forbidden beta decay. (D.C.W.)

7107 (NP-12330(p.137-40)) BETA-GAMMA CIRCULAR POLARIZATION CORRELATION IN Eu^{152}. S. K. Bhattacherjee, Baldev Sahai, and A. A. Padmanabham (Tata Inst. of Fundamental Research, Bombay).

Measurement of Compton scattering from a magnetized iron cylinder gives the degree of circular polarization of gamma radiation. Beta particles are detected using a plastic scintillator while a NaI (Tl) crystal is used to detect gammas. Values obtained for the matrix element ratios compare favorably with earlier values. (D.C.W.)

7108 (NP-12330(p.141-6)) FURTHER STUDIES ON THE DECAY OF Eu^{156}. R. P. Sharma, S. H. Devare, and M. C. Joshi (Tata Inst. of Fundamental Research, Bombay).

Gamma and beta spectra are analyzed and measurements are made of beta-gamma coincidence. The decay scheme is shown and discussed. No evidence was found for a supposed 520-kev level, but an energy level of 800 kev is indicated. Correlation of various gamma levels with beta levels is apparent. (D.C.W.)

7109 (NP-12330(p.147-51)) SEARCH FOR INTERFERENCE BETWEEN RAYLEIGH AND RESONANCE SCATTERING. B. S. Sood (Panjab Univ., Chandigarh, India).

Conditions for interference between two electromagnetic waves are given along with four reasons for the absence of interference between 411-kev E_2 resonance in Hg^{198} and Rayleigh-Thomson components. Speculation is advanced that these reasons are not applicable to 961-kev E1 resonance in Sm^{152}. Data are given and compared with theoretical calculations showing that interference is undetectable, if present. Frequency shifts and time lag between the two processes account for this. (D.C.W.)

7110 (NP-12330(p.152-7)) LIFE-TIME MEASUREMENT OF THE FIRST EXCITED STATE OF Sn^{116}. N. Lingappa, M. D. Deshpande, C. Badrinathan, E. Kondaiah (Tata Inst. of Fundamental Research, Bombay) and M. Balakrishnan (India. Atomic Energy Establishment, Trombay).

Study of resonance florescence of 1.27-Mev gamma rays in the beta decay of In^{116} to Sn^{116} is made. Data are taken from radiation scattered by Cd and Sn upon leaving the source. Measurements are made using a NaI(Tl) crystal detector. The curves reveal that tin gives more scattering. The efficiency of the detector and the respective nonresonant contributions of the scatterers were also determined. The 1.27-Mev level lifetime in Sn^{116} is found to be $(4.9 \pm 0.9) \times 10^{-13}$ sec, compared to 4.2×10^{-13} sec obtained using a Coulomb excitation method. (D.C.W.)

7111 (NP-12330(p.158-61)) SMALL ANGLE COHERENT SCATTERING OF γ-RAYS. A. Nath and A. M. Ghose (Bose Research Inst., Calcutta. Nuclear Physics Lab.).

A 450-mC Co^{60} source is separated from a NaI(Tl) crystal detector on an optical bench by multisection iron filters, a conical lead filter next to the detector, and variable ring scatterers. Spectra for the background, the scattered 1.17- and 1.33-Mev gamma rays, and the sum total are given. Proper background corrections are used in calculating from the Klein-Nishina formula the Compton scattering cross section that is subtracted to yield the coherent scattering cross sections. (D.C.W.)

7112 (NP-12330(p.162-5)) LINEAR POLARIZATION OF BREMSSTRAHLUNG FROM 3.5 Mev ELECTRONS. P. Subrahmanyam and P. Ammiraju (Tata Inst. of Fundamental Research, Bombay).

Results of computations dealing with photon emission angles and using the differential cross sections are discussed. Graphs show angular dependence of low- and high-frequency linear polarization as well as peak polarization versus photon energy peak angle. (D.C.W.)

7113 (NP-12330(p.166-71)) FIRST FORBIDDEN BETA-SPECTRA OF Nd^{147}. S. H. Devare, R. P. Sharma (Tata Inst. of Fundamental Research, Bombay) and Babulal Saraf (India. Atomic Energy Establishment, Trombay).

Beta transitions to the first excited and ground states are given particular attention in a beta spectra investigation of Nd^{147}. A Fermi plot of the beta spectrum is given along with the shape correction curve. Results are checked favorably by taking the beta spectrum in coincidence with 91-kev gamma rays. Retardation of $\Delta I = 1$ allowed transitions from Nd^{147} is concluded. (D.C.W.)

7114 (NP-12330(p.172-8)) SCATTERING OF ELECTROMAGNETIC RADIATION BY FREE ELECTRONS. Vachaspati and Sudarshan L. Punhani (Lucknow, India. Univ.).

Prediction of higher frequencies in the resultant waves than in the incident waves is shown to result from more accurate solution of electron motion equations when monochromatic light is scattered by free electrons. (D.C.W.)

7115 (NP-12330(p.179-85)) ORIENTATION OF Co^{60} NUCLEI IN ALLOY OF COBALT AND IRON. Girish Chandra (Tata Inst. of Fundamental Research, Bombay).

The orientation of Co^{60} nuclei in a ferromagnetic alloy of 50% Co and 50% Fe is undertaken. The technique is minutely described. New insights into certain aspects of metal physics and information on electrons in ferromagnetic elements may result from further experiments. (D.C.W.)

7116 (NP-12330(p.186-92)) DETERMINATION OF PAIR CROSS-SECTION OF GAMMA RADIATION. J. Rama Rao, V. Lakshiminarayana, and Swami Jnanananda (Andhra Univ., Waltair, India).

Experiments to determine pair cross sections for energies close to threshold and Z-dependence of pair cross sections, using various gamma sources, are described. Results are listed for comparison. (D.C.W.)

7117 (NP-12330(p.193-8)) DESIGN-STUDY OF AN EXPERIMENT TO MEASURE THE ABSOLUTE ELECTRON-ELECTRON SCATTERING CROSS-SECTION USING A TRANSVERSE β-RAY SPECTROMETER. R. N. Tripathi and M. R. Bhiday (Mahakoshal Mahavidyalaya, Jubbulpore, India).

Theoretical considerations to be used in making further high-resolution measurements of positron-electron and electron-electron scattering cross sections are discussed. An energy selector giving an almost monoenergetic primary beam incident normally on the scatterer and an adjustable scintillation counter permitting measurement of fractional kinetic energy over a continuous range are to be used. (D.C.W.)

7118 (NP-12330(p.199-201)) A DIRECTIONAL NEUTRON COUNTER FOR FAST NEUTRONS. B. Mitra, A. Chatterjee, A. Nath, and A. M. Ghose (Bose Research Inst., Calcutta. Nuclear Physics Lab.).

Advantages and design of directional counters are discussed, and results obtained using large numbers of parallel plastic filaments as detecting scintillators show that good directional property and relatively high efficiency are obtainable. (D.C.W.)

7119 (NP-12330(p.202-8)) MEASUREMENT OF ALPHA PARTICLE SPECTRA USING SOLID STATE DETECTORS. C. K. Kumar and N. Sarma (India. Atomic Energy Establishment, Trombay).

Measurements of Am and Pu alpha particle spectra are made using semiconductor instead of crystal detectors to test advantages of the semiconductor devices. Results are graphically displayed and indicate a resolution of 1.3 to 1.5%. (D.C.W.)

7120 (NP-12330(p.209-13)) A SIMPLE AND FAST SINGLE-CHANNEL PULSE-HEIGHT ANALYSER. K. Gopalan (Indian Inst. of Science, Bangalore).

An analyzer consisting of an expander amplifier, an upper and lower gate, an anticoincidence circuit, and an output stage transmits pulses falling between the two gate levels. Suggested modification involves bringing the bias potential on C (ample diagrams provided) close to the quiescent cathode voltage only in the triggered state permitting generation of a tail-end pulse without an undue hysteresis. (D.C.W.)

7121 (NP-12330(p.214-19)) PREPARATION OF SODIUM IODIDE-THALLIUM ACTIVATED-SCINTILLATION CRYSTALS. G. K. Bhide (Tata Inst. of Fundamental Research, Bombay).

Procedure used in finishing as well as growing crystals by Stockbarger's modification of Bridgman's technique is given. Scintillation detection tests with resultant crystals show about 12% resolution for a 661-kev gamma peak and indicate good linear response for varying energies. (D.C.W.)

7122 (NP-12330(p.220-3)) CONCENTRATION STUDIES IN PLASTIC SCINTILLATORS. R. Y. Deshpande (India. Atomic Energy Establishment, Trombay).

Preparation and testing of a two-solute plastic scintillator using polystyrene as the base, p-terphenyl as the activator, and POPOP as the wavelength-shifter are described. Pulse-height plotted against POPOP concentration shows an increase with concentration, a wavy structure, and further increase. (D.C.W.)

7123 (NP-12330(p.224-41)) DYNAMIC POLARIZATION OF NUCLEI USING MAGNETIC RESONANCE. B. Venkataraman (India. Atomic Energy Establishment, Trombay and Tata Inst. of Fundamental Research, Bombay)

Orientations of nuclei are discussed using the Abragam-Pryce hamiltonian, and a qualitative description of an idealized dynamic polarization experiment for a system of nuclear spins with $I = \frac{1}{2}$ in hyperfine coupling with electron spins with $S = \frac{1}{2}$ is given. Three specific cases of dynamic nuclear polarization: in a metal; in a diamagnetic containing paramagnetic impurities; and, particularly, in a paramagnetic ion are explored. (D.C.W.)

7124 (NP-12330(p.242-8)) NUCLEAR MAGNETIC RESONANCE SPECTRA OF A_2B_2X SYSTEM. G. Aruldhas and P. Venkateswarlu (Indian Inst. of Tech., Kharagpur).

High resolution of some para-substituted fluorobenzenes ($p\text{-}FC_6H_4NO_2$, $p\text{-}FC_6H_4COOC_2H_5$, $p\text{-}FC_6H_4COCL$, and $p\text{-}FC_6H_4SO_2CL$) is obtained at 40 Mc/sec and analyzed as an A_2B_2X system. Chemical shifts and spin coupling constants are determined by analysis of nuclear magnetic resonance spectra. Data are listed; values for coupling constants comparing favorably with earlier values. Basic functions and diagonal matrix elements for an A_2B_2C system are given. (D.C.W.)

7125 (NP-12330(p.253-7)) CARRIER-FREE SEPARATION OF Eu^{156} AND $Gd^{146,149}$ BY ION EXCHANGE AT ROOM TEMPERATURE. A. T. Rane (Tata Inst. of Fundamental Research, Bombay).

Separation of Eu–Sn and Gd–Eu is effected using Dowex-50 ion exchange resin. Carrier-free sources of Gd^{146}, Gd^{149}, and Eu^{156} are obtained from this procedure, used originally in separating Pm^{148} from Nd and Tb^{161} from Gd. Procedure is described and elution curves display the results. (D.C.W.)

7126 (NP-12330(p.259-76)) MEASUREMENTS OF THE DYNAMIC NUCLEAR POLARISATION IN VERY LOW MAGNETIC FIELDS. P. Parikh (Vithalbhai Patel Mahavidyalaya, Vallabh Vidyanagar, India).

Nuclear magnetic resonance spectrometers using low magnetic fields work equally as well as those using high fields for studying relaxation processes, natural linewidths, modulation effects, electron-coupled-spin-interaction, and Overhauser effect interaction. Low fields, however, lead to weak signals that must be enhanced; the enhancing mechanism discussed here being dynamic nuclear polarization involving application of the Overhauser effect to paramagnetic $(SO_3)_2NO^{2-}$ ions in solution. Discussion of the apparatus and the theoretical considerations involved are given. Graphs display energy levels of the ions in various fields as well as proton polarization. More exact measurements on the earth's magnetic fields may result from further study. (D.C.W.)

7127 (NP-12330(p.295-301)) QUADRUPOLE COUPLING CONSTANTS OF Na^{23} AND B^{11} IN SOME BORATES. S. S. Dharmatti, S. A. Iyer, and R. Vijayaraghavan (Tata Inst. of Fundamental Research, Bombay).

Examination of borates with both triagonal and tetrahedral groups for boron is undertaken using quadrupole coupling constants to distinguish between certain local environments and bonding electron configurations. Procedure is discussed and values for the first and second order lines using samples ($Na_2B_4O_7$, $10H_2O$), ($Na_2B_4O_7$, $5H_2O$), ($Na_2B_4O_7$, $3H_2O$), ($Na_2B_4O_7$, $2H_2O$), and ($Na_2B_4O_7$, $1H_2O$) are given. Na^{23} resonance was observed only in borax and Neobar. B^{11} and Na^{23} resonances are discussed and correlated with the information on coupling constants. Values for B^{11} coupling constants agree well with theory. (D.C.W.)

7128 (NP-12330(p.369-77)) NEUTRON CROSS SECTION MEASUREMENTS IN THERMAL AND SUBTHERMAL ENERGY RANGE. V. P. Duggal and C. L. Thaper (India. Atomic Energy Establishment, Trombay).

Various filters used to remove the higher energy neutrons that present problems in neutron cross section measurements using crystal spectrometers are discussed. Beryllium crystal filters, mechanical velocity selectors, and polycrystalline filters are used for various thermal neutron energies from 0.002 to 0.064 ev. Graphs display the effectiveness of the filters and show results of measurements of the total cross sections of Pt and Pd. (D.C.W.)

7129 (NP-12330(p.378-83)) ENERGY DISTRIBUTION OF THERMAL NEUTRONS IN A SOLID DIFFUSING MEDIUM (BERYLLIUM). R. D. Jain (India. Atomic Energy Establishment, Trombay).

An attempt is made to determine the equilibrium energy distribution of thermal neutrons in a crystalline medium (Be) for regions away from sources and boundaries. Solution of the steady state energy dependent diffusion equation by use of multi-group theory gives the equilibrium energy spectrum. Graphs compare the calculated spectra for three temperatures with the Maxwellian distributions. At T = 300°K the two agree closely, but at low temperatures the effect of the medium's crystalline structure produces divergences. (D.C.W.)

7130 (NP-12330(p.384-91)) INELASTIC SCATTERING OF COLD NEUTRONS BY POLYCRYSTALLINE BERYLLIUM OXIDE IN THE TEMPERATURE RANGE FROM 100°K TO 1000°K. R. J. Begum, I. Madhav Rao, and N. Umakantha (India. Atomic Energy Establishment, Trombay).

Discussion points out the discrepancies in various equations for determining scattering cross sections. An approximation is used to calculate the coherent inelastic scattering cross section for beryllium oxide. Explanation of the experiment is given, and the results obtained for various temperatures are graphed. Values of the Debye temperature derived from neutron cross section data agree with those obtained by specific heat procedures. Various theoretical choices of effective mass and effective scattering cross sections for a molecule in a polyatomic lattice prove satisfactory. (D.C.W.)

7131 (NP-12330(p.392-8)) MULTIPLICATION CONSTANTS OF BeO-U LATTICES USING PULSED NEUTRONS. B. V. Joshi, S. B. D. Iyengar, Satyanarayana (India. Atomic Energy Establishment, Trombay) and C. W. Somanathan (Tata Inst. of Fundamental Research, Bombay).

Use of pulsed neutron sources for determining properties of moderating materials can effect savings in materials used. The feasibility of using this approach with multiplying media is examined by using a heterogeneous lattice arrangement of natural uranium rods in beryllium oxide moderator, an arrangement previously used in steady state tests. A decay constant including a term for the multiplication process and depending on the square of a quantity for the size and shape is determined. Analysis of data obtained is incomplete, but curves showing calculated values of decay constant and shape factor are given. (D.C.W.)

7132 (NP-12330(p.399-406)) VIBRATIONAL SPECTRUM OF SODIUM. S. K. Joshi and M. P. Hemkar (Allahabad, India. Univ.).

Conduction electrons produce difficulties in finding the correct atomic force constants for a calculation of lattice vibrational properties of metals. Various three-term approximations for Na have failed, and a five-term approximation following Houston's method gives an expression for the frequency distribution function. Constants used in calculations come from former works; and graphs display values of specific heat for Na at different temperatures, the lattice vibrational spectrum of Na, and Debye characteristics as a function of temperature. Better agreement is obtained for the Debye curve than was obtained in earlier research. (D.C.W.)

7133 (NP-12330(p.407-14)) CONSEQUENCES OF NUCLEAR RECOIL FOLLOWING THE RADIATIVE CAPTURE OF NEUTRONS BY COBALT-59 IN SOLID COMPLEX MATRIX-II: IRRADIATION EFFECTS OF γ-RAYS PRIOR AND SUBSEQUENT TO NUCLEAR TRANSFORMATION. Manohar Lal, K. S. Venkateswarlu, and J. Shanker (India. Atomic Energy Establishment, Trombay).

The effects of γ radiation before and after nuclear transformations are examined to study further the known tendency of pre-irradiation to affect the nature of the species formed. Mixed crystals containing tris-acetylacetone Co(III) and isomorphous rhodium complexes in several molar ratios were prepared. Rhodium-diluted and undiluted complexes received neutron irradiation, some of the samples having been γ-irradiated previously by exposure to a cobalt source. Plotting the fraction of separable activity of Co^{60} against pre-irradiation gamma dose reveals an increase in separable activity due to prior γ-irradiation for undiluted samples. Diagrams and graphs establish that thermal and radiation annealing are equivalent. (D.C.W.)

7134 (NP-12330(p.415-21)) STUDY OF KINETICS OF THERMAL ANNEALING OF RADIATION DAMAGE ENSUING (n,γ) AND (γ,n) REACTIONS FOR TRIS-ACETYLACETONE Co(III). V. G. Thomas, Amar Nath, and Jagdish Shankar (India. Atomic Energy Establishment, Trombay).

Comparison between the thermal annealing behavior for (n,γ) and (γ,n) reactions in tris-acetylacetone Co(III) irradiated under different conditions is undertaken. After irradiation, isothermal annealing at 110°C for varying times, and chemical separation, a NaI(Tl) scintillation counter is used to get values for calculating the percentage retention. Graphs display annealing time versus retention for both reactions, and a table summarizes thermal annealing data. Damage centers formed are the same for (γ,n) and (n,γ) reactions. (D.C.W.)

7135 (NP-12330(p.422-8)) STUDY OF KINETICS OF THERMAL ANNEALING OF RADIATION DAMAGE ENSUING (n,γ) REACTION FOR BIS-SALICYL ALDEHYDE-TRIETHYLENE TETRAMINE COBALT(III) CHLORIDE. K. Annaji Rao, Amar Nath, and Jadgish Shankar (India. Atomic Energy Establishment, Trombay).

Study of bis-salicylaldehyde-triethylene tetramine cobalt(III) chloride is undertaken to determine the annealing behavior in cobalt chelates with hexadentate ligands as part of the examination of radiation damage produced by (n,γ) reactions. Procedure is explained, and the data are given. More than three reaction components are observed, and evidence shows annealing takes place at a site removed from the original. (D.C.W.)

7136 (NP-12330(p.429-31)) RADIATION DAMAGE IN CALCITE DUE TO THERMAL NEUTRONS. J. M. Luthra (India. Atomic Energy Establishment, Trombay).

Thermal neutron radiation damage in the form of displaced atoms as a result of atom recoils following emission of prompt capture γ rays is examined. Calculations for neutron irradiated calcite of the stored energy and number of displaced atoms due to thermal neutron flux are compared with experimental values of stored energy. Abundance, absorption cross section, and energy of γ-ray isotopes (Ca^{40}, Ca^{42}, Ca^{43}, Ca^{44}, Ca^{46}, and Ca^{47}) are given. Thermal neutrons seem to do about 10% of the experimentally observed damage. (D.C.W.)

7137 (PUC-1962-59) NUCLEAR SPINS AND MOMENTS OF Sc^{44} AND Sc^{44m} (thesis). David L. Harris (Princeton Univ., N. J. Palmer Physical Lab.). Feb. 1962. Contract AT(30-1)-937. 110p.

The nuclear spins and hyperfine structure intervals in the $^2D_{\frac{3}{2}}$ electronic state were measured for Sc^{44} and Sc^{44m} by the atomic beams magnetic resonance method. The results are as follows: I = 2 for 4.0 hour Sc^{44}; and I = 6 for 2.4 day Sc^{44m}. The hyperfine interaction constants are: for Sc^{44} $|A(^2D_{\frac{3}{2}})|$ = 102.6 ± 1.2 Mc/sec, and $|B(^2D_{\frac{3}{2}})|$ = 22.9 ± 14.0 Mc/sec with B/A > 0; and for Sc^{44m} $|A(^2D_{\frac{3}{2}})|$ = 53 ± 2 Mc/sec, and $|B(^2D_{\frac{3}{2}})|$ = 62 ± 50 Mc/sec, with B/A < 0. From these values of B and A the nuclear magnetic dipole moment μ and the electric quadrupole moment Q were obtained: for Sc^{44} $|\mu|$ = 2.55 ± 0.03 n.m., and $|Q|$ = (0.14 ± 0.08) × 10^{-24} cm^2, with $\mu/Q > 0$; and for Sc^{44m} $|\mu|$ = 3.94 ± 0.15 n.m., and $|Q|$ = (0.37 ± 0.29) × 10^{-24} cm^2, with $\mu/Q < 0$. From observations of multiple-quantum resonances in the I = 2 state, the electronic gyromagnetic ratio in the $^2D_{\frac{3}{2}}$ state was determined to be $g_{J=\frac{3}{2}} = 1.2008 \pm 0.0002$ if $\mu_{I=2} > 0$; and 1.1997 ± 0.0002 if $\mu_{I=2} < 0$; The nuclear moments were compared with the odd-group model and with calculations with wave functions having seniority as a good quantum number. It is shown that the magnetic moment of the I = 6 state is satisfactorily accounted for on the odd-group model with the neutron configuration $(f_{\frac{7}{2}})^3 i_{\frac{13}{2}}$. The moment of the I = 2 state cannot be similarly fit with the odd-group model, but it does agree satisfactorily with a calculation assuming pure seniority v = 4 for this state. The signs of both quadrupole moments may be accounted for, using a mixture of odd-group wave functions. (auth)

7138 (PUC-1962-61) RADIOACTIVITY OF T = 0 STATES IN V^{46}, Mn^{50}, Co^{54}, AND Cu^{58}. David C. Sutton and Henry A. Hill (Princeton Univ., N. J. Palmer Physical Lab.). Feb. 20, 1962. Contract [AT(30-1)-397]. 6p.

Results of beta- and gamma-ray scintillation spectrometer investigations of radiations associated with the decay levels in V^{46}, Mn^{50}, Co^{54}, and Cu^{58} are reported. Decay schemes are given diagrammatically for Co^{54} and Mn^{50}. (J.R.D.)

7139 (TID-14799) A SUMMARY OF THE DECAY OF SOME FISSION PRODUCT TIN AND ANTIMONY ISOTOPES. B. J. Dropesky and C. J. Orth (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 34p. (LADC-5217)

The mass assignments, half-lives and radiation characteristics of the isobaric pairs Sn^{126}–Sb^{126}, Sn^{127}–Sb^{127}, Sn^{128}–Sb^{128}, and Sn^{129}–Sb^{129} and the isotope Sb^{130} were investigated. Samples of Sn and Sb chemically separated from reactor-irradiated U^{235} were examined with β- and γ-scintillation spectrometers and β-proportional counters. The gross features of this lengthy program are summarized. (auth)

7140 (TID-14921) INTERMEDIATE COUPLING. Dieter Kurath (Argonne National Lab., Ill.). Dec. 1961. Contract [W-31-109-eng-38]. 24p. (UAC-5883)

Included in the discussion of intermediate coupling are sections concerning modification of the independent-particle model and intermediate coupling calculations. This section is divided into subsections on ingredients and limitations in the calculation, the nature of the residual interaction, and examples and general conclusions. Further discussion is included on rotational interpretation in subsections concerning the Nilsson model and generating procedures. (J.R.D.)

7141 (TID-15182) DIRECT COMPARISON OF THE B^{12} AND N^{12} BETA SPECTRA. Neel W. Glass and Robert W. Peterson (Los Alamos Scientific Lab., N. Mex.). [1962?]. Contract [W-7405-eng-36]. 8p. (LADC-5268)

A direct comparison was made of the B^{12} and N^{12} beta spectra at corresponding points of the spectra below the end points and not at points of equal energy. The data were plotted as N^{12} counts in each channel divided by the corresponding B^{12} counts. (M.C.G.)

7142 (TID-15548) INVESTIGATION OF THE LOW ENERGY GAMMA RAYS IN Xe^{131}. G. D. Hickman (Knolls Atomic Power Lab., Schenectady, N. Y.). [1961]. Contract [W-31-109-eng-52]. 11p.

Angular correlation measurements were performed on the 80-284 kev and 177-364 kev cascades in Xe^{131}. The 80-284 kev directional correlation measurement confirmed the isotropic nature of this correlation, while the A_2 and A_4 Legendre polynomial coefficients were measured as 0.341 ± 0.107 and 0.179 ± 0.165 respectively for the 177-364 kev cascade. An attempt to measure the correlation between the 156-210 kev gamma rays failed, as the major coincidences in the energy region was found to be due to scattering. The branching ratio of the 80-284 kev and 156-210 kev cascades is estimated as at least 50 : 1 and not 5 : 1 as previously reported. (auth)

7143 (TID-17357(Pt.II)) THE IMAGINARY PART OF THE OPTICAL POTENTIAL. Report 735 (Final), Part II. Period covered: January 1, 1957–September 30, 1962. Ahmed F. Mohammed Abdel-Bary and H. J. Hausman (Ohio State Univ. Research Foundation, Columbus). Nov. 1962. Contract AT(11-1)-503. 87p.

A study was undertaken to determine the radial dependence of the imaginary part of the optical potential. It is shown how the work of Gomes is related to the overall self-consistent procedure of Brueckner for calculating the imaginary part of the potential. An alternate method of calculation is introduced which involves a specific knowledge of the wavefunctions of the individual particles of the nucleus. An integration was performed over angular variables to obtain an explicit expression for the nuclear potential in terms of the radial wave functions and in terms of the t-matrix for the interaction of two nucleons. It is shown that by selecting as the specific analytic form of the radial wavefunctions for the calculations the harmonic oscillator wavefunctions of the shell model, the integration can be simplified to a one-dimensional numerical integral over tabulated and elementary functions. In order to compare the results for the shape of the imaginary part of the optical potential with the shape of the nucleus, the nuclear densities which result from the use of harmonic oscillator wavefunctions were calculated. The results for the imaginary part of the optical potential are given for O^{16} and Ca^{40} for incident neutrons of energy 6.5 Mev. (M.C.G.)

7144 (TID-17357(Pt.III)) MEASUREMENT OF TOTAL REACTION CROSS SECTIONS IN THE MASS RANGE A = 45 TO A = 65. Report 735 (Final), Part III. Period covered: January 1, 1957–September 30, 1962. George F. Dell, Jr., and H. J. Hausman (Ohio State Univ. Research Foundation, Columbus). Nov. 1962. Contract AT(11-1)-503. 154p.

Thesis by George F. Dell, Jr.

An experiment is described which was designed to determine some of the complex nuclear potential parameters by measuring the total reaction cross section for a series of nuclei, such as Sc^{45}, V^{51}, Mn^{55}, Cu^{63}, and Cu^{65}, whose Coulomb potentials are near the energy of the 6.75-Mev

proton beam. Results are included on proton spectra and (p,n) and (p,p') cross sections. Other discussion is included concerning sources of error and interpretation of data. (J.R.D.)

7145 (UCRL-6404) SHELL MODEL STUDY OF Mn^{55}. Ervin H. Schwarcz (California. Univ., Livermore. Lawrence Radiation Lab.). Nov. 17, 1961. Contract W-7405-eng-48. 20p.

A shell-model calculation for Mn^{55} was carried out which includes interactions among all neutrons and protons not in closed shells. It is shown that the inclusion of the neutron-proton interactions gives good agreement with the experimental data for reasonable values of the two-particle force range. The magnetic moment and quadrupole moment were also calculated. (auth)

7146 (UCRL-9764) SCATTERING IN THE K = 0 BAND OF ODD-ODD DEFORMED NUCLEI. Neal D. Newby, Jr. (California. Univ., Berkeley. Lawrence Radiation Lab.). July 1961. Contract W-7405-eng-48. 30p.

A displacement of energy levels was observed in the K = 0 band of odd-odd deformed nuclei. It is shown that this shift is due to a particular type of scattering in which the final state is obtained from the initial state by a rotation of 180°. Certain selection rules on the parts of the n-p residual interaction responsible for the shift are stated. The Wigner component of the force cannot contribute to the shift. In certain cases the contribution of all central forces will be strongly damped allowing observation of the tensor force scattering contribution. Numerical results are presented. (auth)

7147 (UCRL-9911) A RECOIL STUDY OF THE REACTION $C^{12}(p,pn)C^{11}$. Sarjant Singh and John M. Alexander (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 24, 1961. Contract W-7405-eng-48. 36p.

Recoil ranges of C^{11} from the reaction $C^{12}(p,pn)C^{11}$ are presented for incident proton energies from 0.25 to 6.2 Bev. From these data it was concluded that a neutron evaporation mechanism cannot be the major mechanism. The results for incident energies of 3 and 6.2 Bev are consistent with a fast reaction consisting of a single inelastic nucleon-nucleon collision. Assuming this mechanism, an average kinetic energy of 19 Mev can be deduced for the struck neutron (before the collision) in the C^{12} nucleus. (auth)

7148 (UCRL-9996) ELASTIC SCATTERING OF 31-Mev He^3 IONS FROM SEVERAL ELEMENTS. George Igo, Jose G. Vidal (California. Univ., Berkeley. Lawrence Radiation Lab.); and Samuel S. Markowitz (California. Univ., Berkeley. Dept. of Chemistry and California. Univ., Berkeley. Lawrence Radiation Lab.). Dec. 31, 1961. Contract W-7405-eng-48. 31p.

The absolute differential cross sections for elastic scattering of 31-Mev He^3 ions on Be, Al, Cu, $Sn^{(nat)}$, Sn^{120}, and Bi were measured in the angular range of approximately 10 to 120 deg in the center-of-mass system. Thin self-supporting foil targets were chosen to span the parameter $A^{\frac{1}{3}}$, where A is the target mass number. The first excited states of the isotopes of these elements had sufficient energy separation from the ground state to enable elastic scattering to be resolved from inelastic scattering. The detection system, consisting of CsI(Tl) scintillation crystals, was capable of 3% pulse-height resolution and 1 degree angular resolution. Characteristically, the light-element angular distributions show strong diffraction effects. The differential cross section divided by the Rutherford cross section decreases exponentially at large angles for the heavy elements, and the differential cross sections break away from Rutherford behavior at angles which increase almost linearly with increase of atomic number of the target nucleus. A comparison of the results for natural Sn, and Sn enriched to 85% in Sn^{120}, indicated that within the experimental uncertainties over the measured angular interval, there were no pronounced isotopic effects. The data are presented both in tabular and graphical form to allow detailed comparison with theory. (auth)

7149 (UCRL-10461) HIGH-ENERGY NUCLEAR REACTIONS OF NIOBIUM WITH INCIDENT PROTONS AND HELIUM IONS (thesis). Ralph Garret Korteling (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 10, 1962. Contract W-7405-eng-48. 105p.

High-energy nuclear reactions initiated by protons and He ions on Nb were investigated. Specific reaction products were selected to represent the low and high deposition-energy processes as well as the production of low-mass products. Excitation functions for these products were determined at 240 to 720 Mev for incident protons, and 320 to 880 Mev for incident He ions. The results from the proton bombardments were compared with values obtained from a Monte Carlo calculation of the cascade-evaporation model. The results from the proton bombardments were also compared with those from He-ion bombardments. In general, the comparison of experimental proton results with the results from the calculation gives satisfactory agreement for the low and high deposition-energy processes with the exception of specific cases such as the (p, pxn) reactions. This agreement might be improved with suitable refinements of the calculation. However, the calculation is not able to predict the production of low-mass products, and therefore another mechanism must be invoked to explain their production. The comparison between the experimentally determined proton and He-ion results shows a remarkable similarity. This similarity was unexpected from a consideration of high-energy processes such as meson production and interaction. The inconsistencies which arise from this observation are presented. In addition, experimental information for the identification and decay properties of the previously unreported Nb^{88} isotope is given. (auth)

7150 ON THE ALPHA ACTIVITY OF NEUTRON DEFICIENT EUROPIUM AND GADOLINIUM ISOTOPES. Antti Siivola (Univ. of Helsinki). Ann. Acad. Sci. Fennicae, Ser. A. VI, No. 109, 1-34(1962). (In English)

Alpha energies and half lives of Sm^{147}, Eu^{147}, Eu^{148}, Eu^{149}, Gd^{148}, and Gd^{150} are measured. Additional alpha decay data for the rare earths are reviewed. The beta decay schemes of Eu^{147} and Eu^{150} are also noted. (T.F.H.)

7151 RELATIVE GAMMA-RAY INTENSITY MEASUREMENTS IN THE DECAY OF Ir^{192}. J. H. Hamilton, S. Hultberg, and W. F. Frey (Vanderbilt Univ., Nashville). Arkiv Fysik, 22: 485-90(1962).

The relative gamma intensities of the 296-, 308-, 317-, 468-, 588-, 605-, and 613-kev transitions in Pt^{192} from the decay of Ir^{192} are measured. The method of external conversion is used to determine the relative intensities, with accuracies of 5 to 15%. (auth)

7152 SINGLE AND DOUBLE INTERNAL BREMSSTRAHLUNG. J. E. Thun, W. D. Hamilton, K. Siegbahn, and K. E. Eriksson (Inst. of Physics, Uppsala and Inst. of Theoretical Physics, Uppsala). Arkiv Fysik, 22: 565-77 (1962).

A theoretical calculation on internal bremsstrahlung IB is presented. The IB cross section is measured for P^{32} by recording coincidences between β particles of a certain energy selected by a magnetic spectrometer and IB photons above 300 kev. The angle between the β particles and pho-

tons is 90°. The experimental result agrees with theory. A theoretical calculation on double (two-quantum) internal bremsstrahlung (DIB) is presented. An experiment in which triple coincidences between the β particle and the related two photons are recorded puts an upper limt to the DIB from P^{32}. An upper limit to the rate of emission of nuclear γ rays in this decay is also obtained. (auth)

7153 PROTON-CAPTURE GAMMA RAYS FROM NITROGEN-13. A. W. Parker and G. G. Shute (Univ. of Melbourne). Australian J. Phys., 15: 443-45(Sept. 1962)

Angular distributions of γ_0 and γ_1, the gamma rays to the ground and first-excited states of N^{13} respectively, are calculated theoretically for the reaction $C^{12}(p,\gamma)N^{13}$ at proton energies of 6.6 to 9.2 Mev. Using a NaI crystal and matched photomultiplier, no evidence is found for γ_0 or γ_1. Upper limits for the (p,γ_0) and (p,γ_1) cross sections are calculated as 2 and 10 μb/sterad respectively. (T.F.H.)

7154 EFFECT OF NUCLEAR RECOIL ON THE IONIZATION CAUSED BY A SHARP CHANGE OF CHARGE BY RADIOACTIVITY. M. Demeur and M. Meert. Bull. Classe Sci., Acad. Roy. Belg., 48: 311-19(Mar. 1962). (In French)

The influence of the nuclear recoil on ionization accompanying a sudden change of charge of the nucleus was evaluated. The numerical result is one order of magnitude too small for explaining the experimental data concerning the decay of He^6. (auth)

7155 NUCLEAR TRANSFER REACTIONS. [PART] III. A. Gribaumont (Université Libre, Brussels). Bull. Classe Sci., Acad. Roy. Belg., 48: 320-8(Mar. 1962). (In French)

The problem of relative population of levels with different total angular momentum formed by two neutrons coupling at the time of transfer is studied by the sudden approximation method. It is shown that a modification of the statistical density does not appear until the second approximation. As an example, the case of two neutrons in the state $1\,\underline{p}\,3/2$ is treated. (auth)

7156 A CALCULATION OF THE ENERGY LEVELS OF THE FIRST ROTATIONAL BAND OF Ne^{20}. James D. Talman (Univ. of Western Ontario, London). Can. J. Phys., 40: 1730-5(Dec. 1962).

The energies of the levels in the first rotational band of Ne^{20} are calculated, using a model that combines the shell-model aspect of the problem with the rotational nature of the observed spectrum. The results agree with experimental observations. (auth)

7157 ENERGY LOSS IN CONDENSED MATTER OF H^1 AND He^4 IN THE ENERGY RANGE $4 < E < 30$ kev. Arie Van Wijngaarden and Henry E. Duckworth (McMaster Univ., Hamilton, Ont.). Can. J. Phys., 40: 1749-64(Dec. 1962).

Measurements are reported of the energy loss suffered by H^1 and He^4 particles of 4 to 30 kev energy in passing through thin films of carbon, aluminum oxide, and VYNS. Only particles that emerge in the forward direction are studied. Evidence is presented for identifying the stopping cross sections per atom observed in this way with S_e, the electronic component of the total stopping cross section per atom. It appears that the calculated energy dependence of $S_e(\propto \sqrt{E})$ is somewhat in error, and that the magnitudes of the S_e's for He^4 are systematically too small by 10 to 15%. (auth)

7158 ON THE THEORY OF RADIATIVE CAPTURE OF 1S ORBITAL ELECTRONS. Guy Paquette (Univ. of Montreal). Can. J. Phys., 40: 1765-71(Dec. 1962).

A nonrelativistic calculation of the continuous gamma spectrum accompanying the capture of 1S orbital electrons in Ar^{37} is presented. The calculation takes into account the retardation effects in treating the electromagnetic interaction. A comparison with the relativistic calculation shows that relativistic effects and screening corrections do not affect the high-energy part of the gamma spectrum. On the other hand, the retardation effects are important over the whole spectrum, except at the very lowest photon energies. The method employed in the calculation allows the relative importance of various intermediate states to be ascertained, in their contribution to the spectrum intensity. (auth)

7159 EXCITATION CURVES AND ANGULAR DISTRIBUTION IN THE $N^{14}(d,p)N^{15}$ REACTION. Serge Gorodetzky, Pierre Fintz, and André Gallman. Compt. Rend., 255: 879-81(July 30, 1962). (In French)

Excitation curves as well as the angular distribution of protons going to the ground level of N^{15} were measured in the reaction $N^{14}(d,p)N^{15}$ for deuterons with energy between 0.5 and 5.5 Mev. The results obtained are in agreement with a predominantly direct interaction process. (tr-auth)

7160 THE γ RADIATION EMITTED DURING THE DECAY THORIUM-234 (URANIUM X_1) → METASTABLE PROTACTINIUM-234 (URANIUM L_2). Roger Foucher, Jean Mérinis, Alceu de Pinho, and Manuel Valadares. Compt. Rend., 255: 882-3(July 30, 1962). (In French)

A study was made by magnetic spectrography at 180° of the conversion electron spectra of the γ radiation emitted by Pa^{234m}. The existence of a ray at 29.88 kev (E_2), of 2 rays at 63.21 ($M_1 + E_2$) and 63.64 (E_1) kev and of 2 rays at 93.8 (M_1) and 93.52 (E_1) kev was deduced. (tr-auth)

7161 CONVERSION ELECTRON SPECTRUM OF EXCITED LEVELS OF TUNGSTEN-182. Jaime Araujo Moreira (Laboratoire de l'Aimant-Permanent, Orsay, France). Compt. Rend., 255: 884-6(July 30, 1962). (In French)

The internal conversion spectrum and the Auger electron spectrum emitted during the decay $Ta^{182} \rightarrow W^{182}$ were studied with magnetic spectrographs with semicircular focusing. From the conversion ratios from several γ the nature of the transitions was determined (for some of them, for the first time). In particular, the normality of these ratios for E_1 of 152.5 kev was not confirmed. The multipolarities determined from the ratios of the L sublevels are coherent with the respective ratios of the M sublevels obtained from the Rose tables. (tr-auth)

7162 γ SPECTRA AND PERIODS OF THE 170 AND 171 ISOTOPES OF HAFNIUM AND LUTETIUM. Jacques Valentin, Jean-Louis Sarrouy, and Isaac Chavet (Faculte des Sciences, Orsay, France). Compt. Rend., 255: 887-9(July 30, 1962). (In French)

Isotopically separated sources permitted the identification of the γ spectra of the 170 and 171 isotopes of Hf and Lu. It was determined that the half life of Hf^{171} is 10.7 ± 0.3 hr and that of Hf^{170} is 12.2 ± 0.5 hr. (tr-auth)

7163 ANGULAR DISTRIBUTION OF α PARTICLES FROM THE REACTION $B^{11}(p,\alpha_0)$ FROM 140 TO 550 kev (EXPERIMENTAL RESULTS). Henri Beaumevieille, Nicole Longequeue, and Jean-Pierre Longequeue (Université Grenoble, France). Comp. Rend., 255: 1340-2(Sept. 3, 1962). (In French)

The angular distribution of α particles from $B^{11}(p,\alpha_0)$ was measured using semiconductor detectors. The precision of the energy measurement by magnetic resonance is of the order of 3×10^{-3}. Results are shown graphically, and the determination of the coefficients b_0, b_1, b_2, and b_3 of Legendre polynomials is tabulated. (J.S.R.)

7164 A NEW METHOD FOR THE MEASUREMENT OF DYNAMIC NUCLEAR POLARIZATION. Anatole Abra-

gam, Michel Borghini, and Maurice Chapellier. Comp. Rend., 255: 1343-5(Sept. 3, 1962). (In French)

A method for the measurement of the dynamic polarization of nuclei, without observation of the nuclear resonance signal, is described. The Lorentz field created by these nuclei at the site of paramagnetic impurities which assist polarization is measured. Some preliminary experimental results, with polarizations of the order of 20%, are compatible with the formula $H_n = 4\pi M/3$. (tr-auth)

7165 ANGULAR DISTRIBUTIONS IN THE REACTION $B^{11}(d,p)B^{12}$. Serge Gorodetzky, Pierre Fintz, and André Gallmann. Compt. Rend., 255: 1505-7(Sept. 24, 1962). (In French)

The angular distributions of protons going to the 2.62 and 3.38 Mev levels of B^{12} and the angular distributions of deexcitation γ rays of the first two excited levels of B^{12} toward the ground level were measured. The results are coherent with a negative parity and an angular moment of 1 or 2 for the 2.62-Mev level and favor the value $J = 2^+$ for the 0.95-Mev level of B^{12}. (tr-auth)

7166 THE MEASUREMENT OF THE POLARIZATION OF PROTONS SCATTERED ELASTICALLY ON CARBON. P. Bém, J. Habanec, O. Karban, and J. Němec. Czech. J. Phys., 12: 660-4(1962). (In Czech)

The polarization of protons scattered elastically by carbon was measured using a 6.5-Mev proton beam. The angular distribution was found in the energy interval from 3.60 to 4.52 Mev. The results were compared with calculations. (auth)

7167 THE INFLUENCE OF THE SPIN-ORBITAL BOND ON DIRECT PHOTONUCLEAR REACTIONS (γ,n) AND (γ,p). E. Navrátil (Faculty of Technical and Nuclear Physics, Prague). Czech. J. Phys., 12: 734-7(1962). (In English)

A model for direct photonuclear reactions is modified by using the wave functions of a shell model with spin-orbital bond. It is shown that the introduction of spin-orbital interaction does not influence the cross section. The changes caused by the spin-orbital bond are apparent only in the angular distribution, which has the form $a + b \sin^2 \vartheta$, where b/a is the anisotropy coefficient. Selection laws $j \rightarrow j$, $j \rightarrow j \pm 1$ are found. The introduction of spin-orbital interaction permits the negative value of the anisotropy coefficient found in experiment to be explained in a natural way. (auth)

7168 A STUDY OF THE REACTION $Al^{27}(p,\alpha)Mg^{24}$. M. Skřivánková and J. Šimková (Inst. of Nuclear Research, Czechoslovak Academy of Science, Prague). Czech. J. Phys., 12: 800-1(1962). (In English)

Angular distributions from the reaction $Al^{27}(p,\alpha)Mg^{24}$ are measured at proton energies of 6.05 to 6.50 Mev. Distributions of alpha particles leading to the ground and first excited states of Mg^{24} are determined separately. It is inferred from these distributions that both direct and compound-nucleus mechanisms are active in the reaction. (T.F.H.)

7169 THE EMISSION OF DELAYED PROTONS DURING THE POSITRON DECAY OF NEUTRON-DEFICIENT NUCLEI. V. I. Gol'danskii (Inst. of Chemical Physics, Academy of Sciences, USSR). Doklady Akad. Nauk SSSR, 146: 1309-11(Oct. 21, 1962). (In Russian)

The emission of a delayed proton from a number of the lighter elements can be predicted by directly comparing the mechanism of positron decay of the unknown neutron-deficient isotope with the mechanism of electron decay of a known mirror isotope having an excess of neutrons. For example, ${}_{10}Ne_7^{17}$ should emit a delayed proton, since its mirror isomer ${}_7N_{10}^{17}$ emits a delayed neutron. The mass defect of Ne^{17} is ${}_{10}D_7 = 21.4$ Mev, which corresponds to a maximum energy of 13.4 Mev for the β^+ decay to the ground state of F^{17}. The binding energy of a proton in F^{17} is $B_p = 0.6$ Mev. Since the ground state of Ne^{17} (similar to N^{17}) should be $\frac{1}{2}-$, while the ground state of F^{17} is $\frac{5}{2}+$, Ne^{17} should decay by β^+ emission with formation of 3.1 ($\frac{1}{2}-$) and 4.4 Mev ($\frac{3}{2}-$) excited levels of F^{17}, and with subsequent emission of 2.5 and 3.8 Mev protons. With an estimated log ft ≅3.7, the half life of Ne^{17} should be about 0.03 sec. If the excitation energy E^* of a residual nucleus (after β^+ decay) exceeds the binding energy of a proton in this nucleus, emission of a delayed proton is possible. By using mass data on neutron-deficient isotopes, it was found that emission of a delayed proton after β^+ decay is possible by starting with the following isotopes having an even atomic number: Ar^{33}, Ca^{37}, or Ca^{35}, Ti^{39}, Cr^{43}, Fe^{47}, Ni^{51}, Zn^{57}, Ge^{61}, Se^{65}, Kr^{69}, Sr^{73}, Zr^{77}, Mo^{81}, Ru^{87}(?), Pd^{91}, Cd^{95}, and Sn^{99}. The half life should decrease smoothly from ~1 sec for Ar to ~0.1 sec for Sn. Emission of a delayed proton is also possible for four odd-odd isotopes (K^{34}, V^{42}, Mn^{46}, and Co^{50}). (TTT)

7170 DISTORTED WAVE BORN APPROXIMATION CALCULATIONS FOR THE REACTIONS $Ne^{20,22}(d,n)Na^{21,23}$. W. R. Gibbs, W. Grueebler, and J. Rossel (Universite, Neuchatel, Switzerland). Helv. Phys. Acta, 35: 281-3 (1962). (In French)

The results of a series of distorted-wave Born approximation calculations on the reactions $Ne^{20,22}(d,n)Na^{21,23}$ are presented graphically. The theoretical calculations for the angular distributions of neutrons for various energy levels of the nuclei formed are compared with experimental results and with the results given by the Butler theory. (J.S.R.)

7171 MEASUREMENT OF THE 1ST EXCITED LEVEL OF Na^{21} USING A (n,γ) COINCIDENCE. W. Grueebler, J. Seylaz, and J. Rossel (Universite, Neuchatel, Switzerland). Helv. Phys. Acta, 35: 284-7(1962). (In French)

The first excited level of Na^{21} was measured by direct determination of the γ energy. The apparatus used to eliminate the γ released from the associated reaction $Ne(d,p\gamma)Ne^{21}$ is shown schematically and briefly described. The results gave a value of 0.345 ± 0.015 Mev for the energy of the first excited level. (J.S.R.)

7172 THE DECAY OF Ir^{192}. J. Kern and L. Schellenberg (Universite, Freiburg i. B.). Helv. Phys. Acta, 35: 313-20(1962). (In French)

The decay of Ir^{192} was studied with a double-focusing spectrometer in order to prove the linearity of the relation between the reading of the potentiometer which controls the magnetic field and the $B\rho$ pulse of electrons. Two series of measurements on the internal and external conversion show that the calibration of the potentiometer is linear and that the $B\rho$ values obtained remain within the limits of error of the best values measured or calculated from triangular relations. The gamma and electron transitions observed are tabulated and compared with previously published values. The decay scheme is given. (J.S.R.)

7173 ABSOLUTE PRECISION DETERMINATION OF SEVERAL RESONANCE AND THRESHOLD ENERGIES AND THE α PARTICLES ENERGY OF Po^{210}. PART II. A. Rytz, H. H. Staub, H. Winkler, and W. Zych (Universität, Zurich). Helv. Phys. Acta, 35: 341-50(1962). (In English)

Improved precision measurements of the energy and

half-value width of $Al^{27}(p,\gamma)Si^{28}$ and $F^{19}(p,\alpha,\gamma)O^{16}$ resonances in contrast with earlier studies are described. The new magnetic 180° spectrometer has 0.04- or 0.11-mm wide slit with 1-m orbit diameter. The measurement results agree within statistical deviation with the theoretical yield curves determined by a balancing calculation. The resonance energies measured on thick targets are 871.80 ± 0.25 kev for fluorine and 991.83 ± 0.10 kev for aluminum. The half-value width is shown to be 4.8 ± 0.2 kev and 100 ± 20 ev respectively. (tr-auth)

7174 DIFFERENTIAL EFFECTIVE CROSS SECTION OF OXYGEN-16 FOR NEUTRONS IN THE Mev ENERGY RANGE. W. Hunzinger and P. Huber (Universität Basel). Helv. Phys. Acta, 35: 351-66(1962). (In German)

Differential scattering cross section for neutrons on O^{16} were measured at sixteen energies between 2.00 and 4.11 Mev. Using an ionization chamber, the energy distribution of the recoiling nuclei were observed with a 49-channel pulse height analyzer. The results are represented graphically as angular distributions and tabulated as coefficients of Legendre polynomals. (auth)

7175 GAMMA AND INTERNAL CONVERSION ELECTRON SPECTRA IN Gd ISOTOPE (n,γ) REACTION. L. V. Groshev, A. M. Demidov, V. A. Ivanov, V. N. Lutsenko, and V. I. Pelekhov. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1118-33(Sept. 1962). (In Russian)

A magnetic Compton spectrometer with 0.3% resolving power at $E_\gamma > 2$ Mev and 0.6% at $E_\gamma = 1$ Mev was used in an investigation of Gd^{155} and Gd^{157} γ spectra at 0.4 to 9 Mev. The internal conversion electrons at 20 kev to 3 Mev were also studied. The measurements were made using Gd_2O_3 enriched in Gd^{155} and Gd^{157}. The thermal neutron capture cross sections for Gd^{155} and Gd^{157} are 61000 ± 5000 C and 240000 ± 12000 C, respectively. For other gadolinium isotopes the cross sections are considerably smaller. Thermal neutron capture was 85% in Gd^{155} and 15% in Gd^{157}. (R.V.J.)

7176 ELASTIC PROTON SCATTERING BY B^{10} NUCLEI. G. B. Andreev, A. S. Deinenko, and I. Ya. Malakov. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1134-6(Sept. 1962). (In Russian)

Elastic proton scattering by B^{10} was studied in order to verify published data on the excited state of C^{11} at 12.5 Mev in proton reactions: $B^{10}(p,\gamma)C^{11}$, $B^{10}(p,p)B^{10}$, $B^{10}(p,\alpha)Be^7$, and $B^{10}(p,\alpha,\gamma)Be^7$. The relative differential cross section of elastic scattering, $B^{10}(p,p)B^{10}$, measured at 110, 125, and 141° angles in the center-of-mass system at 1 to 3.5 Mev, showed three wide resonances at $E_p = 1.5$, 2.2 ($\theta_{cm} = 141°$), and 3 Mev. The wide resonance was not present in either $B^{10}(p,\gamma)C^{11}$ or $B^{10}(p,\alpha)B^7$ at 2.2 Mev ($\Gamma > 200$ kev). (R.V.J.)

7177 DECAY SCHEME AT 8.92 Mev AND QUANTUM CHARACTERISTICS OF K^{41} LOWER LIMITS. A. K. Val'ter, Yu. P. Antuf'ev, E. G. Kopanets, A. N. L'nov, and S. P. Tsytko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian, SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1137-42(Sept. 1962). (In Russian)

A double-crystal coincidence spectrometer was used in studies of K^{41} energy levels in $Ar^{40}(p,\gamma)$ reactions at 8.92 Mev. The studies were confined to only one resonance at $E_p = 1107.5$ kev. It was postulated that spins and parities of $\frac{1}{2}^-$, $\frac{3}{2}^-$, $\frac{5}{2}^-$, and $\frac{7}{2}^-$ correspond to 1.0, 1.6, 2.6, and 8.82 Mev. The sequence of spins $\frac{1}{2}$, $\frac{3}{2}$, and $\frac{5}{2}$ is in good agreement with calculations made by P. Sudhir et al. (Progr. Theoret. Phys., 19: No. 4, 3404(1958)) using shell model and strong j-j coupling. (R.V.J.)

7178 INELASTIC PROTON SCATTERING ON Ni AND Cu AT 6.6 Mev. S. S. Vasil'ev, E. A. Romanovskii, and G. F. Timushev (Moscow State Univ.). Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1143-9(Sept. 1962). (In Russian)

A detailed analysis of inelastic proton scattering on $Ni^{58,60}$ and $Cu^{63,65}$ at $E_p = 6.6$ Mev was made in order to determine the mechanism of the reaction. Previous experiments indicated smooth cross section changes in elastic proton scattering on $Cu^{63,65}$ that were well described by an optical model. The latter did not hold true for $Ni^{58,60}$ and indicated the probability of a compound nucleus process. However, the data on (p,p'γ) correlations in Ni^{58} and Ni^{60} at $E_p = 6.9$ Mev exhibited a direct process in Ni^{60} but that was absent in Ni^{58}. The total cross sections for Cu^{63} and Cu^{65} at $E_p = 6.6$ Mev are ~600 b. The sums of partial cross sections are 230 ± 20 mb for Ni^{58} and 250 ± 30 mb for Ni^{60} at 3.5 Mev. In the case of proton reaction with Ni^{58} and Ni^{60} at $E_p = 6.6$ Mev the cross sections for p-p processes through compound nucleus formation are ~300 to 350 mb. Thus, the results support the postulation on anomalous elastic proton scattering on Ni^{58} and Ni^{60} that the increased elastic cross sections at large scattering angles are produced by larger contributions from p-p processes evolving compound nucleus states. (R.V.J.)

7179 EXCITATION STATE OF Be^8 IN $Li^7(p,\alpha)He^4$ REACTION. I. B. Teplov, I. S. Dmitriev, Ya. A. Teplova, and O. P. Shevchenko. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1150-3(Sept. 1962). (In Russian)

Energy levels of Be^8 in $Li^7(p,\alpha)He^4$ reaction at $E_p = 3.3$ to 6.55 Mev are analyzed. The curves of excitation levels at 5.25 to 6.55 Mev for 30° center-of-mass and at 3.3 to 6.55 Mev for 80° showed two resonances in the vicinity of 3.0 and 5.6 Mev. The 3-Mev resonance was previously established by D. R. Inglis (Phys. Rev., 74: 21(1948)), who suggested that the angular distribution of α particles in the resonance appeared in the intermediate 2^+ state at 19.9 Mev, width $\Gamma = 1$ Mev, and in the 0^+ state with a width of several Mev above the resonance. The resonance at 5.6 Mev is explained by Be^8 excitation at 22.3 Mev and $\Gamma = 1$ Mev width or by other excitations at 22.3 Mev with at least one 2^+ spins state. (R.V.J.)

7180 CONVERSION ELECTRON COINCIDENCES IN Lu^{174*} DECAY. B. S. Dzhelepov, E. N. Rozhin, and V. A. Sergienko (Leningrad State Univ.). Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1154-8(Sept. 1962). (In Russian)

A double-lens β spectrometer was used in coincidence studies of conversion electrons produced in Lu^{174*} ($T_{1/2}$ ~ 165 day) decay. The Lu^{174*} source, prepared by Ta + p reaction at 660 Mev, contained small amounts of Li^{173}. The conversion electron spectra of Lu^{174*} and Lu^{173} at 20 to 100 kev were constructed. The Lu^{174*} decay scheme at 170.8 kev is in agreement with previously suggested schemes, and coincidences between electrons from 44.6, 59.1, and 67.1 kev transitions confirm the presence of three-cascade transitions. (R.V.J.)

7181 DECAY SCHEME OF Eu^{148}. Yu. A. Aleksandrov and P. Shelike (Leningrad State Univ.). Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1162-3(Sept. 1962). (In Russian)

A scintillation coincidence spectrometer was used in an investigation of γ spectra and γ-γ coincidences in Eu^{148} decay at 1200 to 2500 kev. Excitation states of Sm^{148} in Pm^{148} β decay were determined. Excited states at 551, 1181, 1599, 1906, and 2096 kev were observed in Sm^{148} during Eu^{148} decay. Further studies of γ emissions indicated γ transitions at 420, 550, 630, 730, 910, 1020, 1230, 1330, 1540, and 1610 kev and the previously reported transitions at 1910, 2090, 2200, and 2410 kev. The experimental data imply the presence of previously unknown Sm^{148} ex-

cited states at 2200, 2410, 2510, and 2790 kev in Eu^{148} decay. (R.V.J.)

7182 ENERGY SPECTRUM OF INTERNAL CONVERSION PAIRS PRODUCED IN RADIATIVE THERMAL NEUTRON CAPTURE IN Gd. G. V. Danilyan and I. Ya. Korol'kov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1164-8(Sept. 1962). (In Russian)

An improved magnetic double-spectrometer with 4×10^{-3} sec resolving power, oriented to 0 and 60° geometric angle between recorded pair components and equipped with scintillation counters was used in an investigation of the angular distribution between electron-positron internal conversion pairs. The geometric scheme of the 45-mm diameter, 5-μ-thick aluminum foil exposed to the 10^8 cm^{-2} sec^{-1} thermal neutron beam from the horizontal channel of a heavy water reactor eliminated the interfering γ background. The spectrum of internal conversion pairs in Gd thermal neutron radiative capture was constructed and analyzed. (R.V.J.)

7183 CALCULATIONS OF INTRANUCLEAR CASCADE BY ONE-DIMENSIONAL THEORY OF SHOWERS. M. Z. Maximov (Inst. of Physics and Tech., Academy of Sciences, Georgian SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1172-9(Sept. 1962). (In Russian)

A generalized Bohr concept of nuclear reactions and aspects of three-stage nuclear reactions are analyzed in order to define nuclear reaction mechanisms. The intranuclear cascade was calculated using the one-dimensional theory of showers. The specific energy losses in fast particle interactions with nucleons are evaluated. (R.V.J.)

7184 COLLECTIVE EXCITATIONS OF NUCLEI IN SCATTERING OF FAST PARTICLES. V. I. Belyak. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1180-7(Sept. 1962). (In Russian)

Scattering cross section and nuclear parameter ratios (electric transition and quadrupole moment probabilities) were developed for arbitrary collective nuclear excitation under certain general assumptions for particle-nuclear surface interactions. The developed relations are applied in diffraction and Bohr approximations for small angle scattering. (R.V.J.)

7185 SUPERMULTIPLEX LEVEL STRUCTURE AND PECULIARITIES OF (γ,d) REACTION ON LIGHT NUCLEI. V. V. Balashev and V. N. Fetisov. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1188-9(Sept. 1962). (In Russian)

A strong depression of photodeuteron emission ($E_d > 15$ Mev) extending from the kinematic threshold to a magnitude exceeding the threshold was observed previously in $Li^6(\gamma,d)$, $B^{10}(\gamma,d)$, and $Be^9(\gamma,d)$ reactions. The magnitude of the shift indicates the probability of deuteron emission followed by the emission of an additional nucleon. The above phenomenon is analyzed by applying the supermultiplet structure theory to the $Be^9(\gamma,d)$ reaction, assuming all fast deuterons are specified by direct deuteron stripping from a Be^8 base. The calculations show that the peculiarities of (γ,d) reactions result from specific selection rules related to the light-nucleus supermultiplet structure and indicate that deuterons have an integral value and isotopic spin. The selection rule does not hold for reactions with nucleon or triton emission of $S = \frac{1}{2}$ and $T = \frac{1}{2}$ residue particles. The threshold shift was also observed in other nuclei with $A = 4n + 1$ (C^{13}, O^{17}, etc.). (R.V.J.)

7186 ON THE PROBLEMS OF NUCLEAR STRUCTURE IN HIGH-ENERGY PARTICLE REACTIONS WITH NUCLEI. P. A. Gorichev, O. V. Lozhkin, and N. A. Perfilov. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1190-3 (Sept. 1962). (In Russian)

High-energy particle (10^2 to 10^4 Mev) reactions with heavy nuclei are well described by the cascade-evaporation model in which the incoming particle reaction is considered a two-stage Fermi gas. The first stage, developed in nucleon-nucleon cascade interactions, results in general system excitation. The stripping of the excitation takes place in the slower particle evaporation stage. However, certain processes in high-energy interactions cannot be explained within the cascade-evaporation model. Certain aspects of a model based on the fragmentation process as a direct nuclear reaction (with grouped nucleons acting as a unit) are analyzed. The probability of fragmentation in strongly excited nuclei is suggested. It is shown that the development of a nuclear model with associated nucleons is required for further studies of nuclear processes. (R.V.J.)

7187 OPTICAL POTENTIAL AND GREEN'S FUNCTION. S. G. Kamenskii (Voronezh State Univ., USSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1194-5(Sept. 1962). (In Russian)

An optical potential and Green's function method was used in studies of heavy nuclei (without recoil) in $|n>$ states and possessing n particles with an arbitrary particle being elastically scattered during a transition from the energy state E_p with $\underline{p}$ momentum to the E_q state with $\underline{q}$ momentum. Two visual illustrations of electron elastic scattering are analyzed. (R.V.J.)

7188 SPECTROSCOPIC ASPECTS OF FAST NUCLEON REACTIONS WITH LIGHT NUCLEI. V. V. Balashov and A. N. Boyarkina. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1196-8(Sept. 1962). (In Russian)

An intermediate bond model was used in the evaluation of excitation spectra in (p,np) knock-out reactions. The observed differences in the cross sections for N^{14} (7.3 ± 0.7 mb) and its neighbors C^{12} (29 ± 3.3 mb) and O^{16} (33 ± 5 mb) are explained by C^{12} and O^{16} transitions that are related (almost 100%) to the finite nuclear level, while only 20% of N^{14} transitions are related to the N^{13} ground state with $I = \frac{1}{2}^-$ and 80% lead to the excited state above the nucleon threshold without contributing to $N^{13} \rightarrow C^{13}$ β decay. Schemes of partial transitions for (p,np) in C^{12}, N^{14}, and O^{16} are given. Using Feynman diagram language and the simplest pole diagrams for (p,2p) and (p,np) reactions, it was shown that the shell model (considering residual interactions) is capable of describing the nuclear vertex of diagrams expressing virtual dissociation processes: $N^{14} \rightarrow C^{13} + p$, $C^{12} \rightarrow C^{11} + n$, and etc. Moreover, the model enables evaluations of various excited states of finite nuclei with hole characteristics. (R.V.J.)

7189 PARTIALLY NORMALIZED α WIDTHS IN NUCLEAR α MODEL. Z. Matkhiz, V. G. Neudachin, and Yu. F. Smirnov. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1199-1208(Sept. 1962). (In Russian)

The partially normalized α width of O^{16} was calculated using the α model in order to determine the level structure and to correlate various models for O^{16}. The α width was evaluated for the 2 typical levels (the abnormally large width of Wigner limit 1 and the normal width of Wigner limit 0.05). The correlations of α- and shell-model results were accomplished by correlating the data on the α width for the 0^+ level in C^{12} at 7.65 Mev. The suggested method for calculating the width can be used for evaluating excitations of finite nuclei in quasi-elastic scattering (α,2α), (p,pα), and (γ,pt) reactions at large proton, α, and γ energies. (R.V.J.)

7190 EFFECTS OF PAIR CORRELATIONS ON TWO-γ QUANTUM PROCESSES IN NUCLEI. L. P. Rapoport and A. G. Krylovetskii (Voronezh State Univ., USSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1209-14(Sept. 1962). (In Russian)

The effects of pair correlations in 2 γ-quantum processes were evaluated within the limits of the composite model by means of ordinary field scattering theory generalized for the case of pair interactions as calculated by Bogolyubov. (R.V.J.)

7191 EFFECTS OF DIPOLE NUCLEAR CORE POLARIZATION ON THE PROBABILITIES OF SINGLE PARTICLE TRANSITIONS. N. P. Yuden. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1215-17(Sept. 1962). (In Russian)

A distinct determination of dipole resonance in nuclear photo-absorption cross sections enables an evaluation of the probabilities of external nucleon transitions induced by dipole excitation of the nuclear core. An analysis was made of the E1 transition with variations in the external nucleon state. Due to nuclear interactions the amplitude is determined by the amplitude sum of processes described by Feynman graphs. The results showed that E1 transition probabilities are $\frac{1}{4}$ to $\frac{1}{2}$ the values obtained in the single-particle model. The suppression effect of single-particle dipole transition is increased with increased mass number due to the increased amplitude in E1 absorption by the nuclear core and to a reduced dipole energy maximum. (R.V.J.)

7192 PARTICLE-HOLE INTERACTIONS IN NUCLEAR SHELL MODEL. N. P. Yudin. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1218-21(Sept. 1962). (In Russian)

The basic shell-model expressions for particle-hole interactions are analyzed and evaluated. (R.V.J.)

7193 EFFECTS OF NUCLEON SURFACE REACTION ON O^{16} PHOTOSPALLATION. N. P. Yudin. Izv. Akad. Nauk SSSR, Ser. Fiz., 26: 1222-4(Sept. 1962). (In Russian)

The hyperfine structure of dipole resonance in O^{16} photoabsorption was studied in order to find separate levels producing dipole resonance and to interpret them theoretically by relatively simple calculations. The distribution of dipole transition intensities produced by ordinary shell interactions with nuclear surface oscillations (phonons) was studied. Interactions with phonons reduce the energy of levels carrying the greater part of the dipole sum. A certain increase in paired interaction amplitude is required for agreement with experiment. The observed dipole resonance spallation is interpreted within a shell model with phonon excitation when $\hbar\omega \sim 10$ Mev, $V_0 = 45$ Mev. At higher $\hbar\omega$ collective levels fade from the dipole resonance region. Thus at $\hbar\omega > 15$ Mev, interactions with phonons cannot explain the hyperfine dipole resonance structure. (R.V.J.)

7194 NEW NEUTRON-DEFICIENT BARIUM ISOTOPES. I. L. Preiss and P. M. Strudler (Yale Univ., New Haven, Conn.). J. Inorg. Nucl. Chem., 24: 589-92(Nov. 1962). (TID-14608)

New barium activities, produced by heavy ion bombardments of indium and tin, were assigned on the basis of chemistry and their decay to cesium daughters. The are: Ba^{123}, 2 ± 0.5 min; Ba^{125}, 6.5 ± 0.5 min; and Ba^{127}, 10.0 ± 0.5 min. In addition the following half lives were proposed for previously assigned nuclides: Ba^{126}, 103 ± 5.0 min; Cs^{123}, 8.0 ± 0.5 min; Cs^{125}, 49 ± 5.0 min; and Xe^{123}, 1.85 ± 0.1 hr. (auth)

7195 IONIZATION POTENTIAL AND NUCLEAR MAGNETIC MOMENTS OF PLUTONIUM. C. Berthelot (Bureau Central de Mesures Nucleaires (Euratom), Geel, France). J. Phys. Radium, 23: 447-8(July 1962). (In French)

The nuclear magnetic moment of Pu was calculated from recent data on the hyperfine structure of the Pu spectra. Calculations of the ionization potential were made by taking into consideration Breit-Crawford-Schawlow and Bohr-Weisskopf correction factors and the variations of the effective quantum number. A value of 5.5 v was fourd for the ionization potential. The nuclear magnetic moment of Pu^{239} is 0.61 ± 0.10 and of Pu^{241} is 2.15 ± 0.36. (J.S.R.)

7196 A SEARCH FOR AN E4 CROSS-OVER TRANSITION IN THE ISOMERIC DECAY OF ^{204}Pb. Kasuke Takahashi and Kyûya Kotajima (Tokyo Univ.). J. Phys. Soc. Japan, 17: 1815-17(Dec. 1962). (In English)

An E4 cross-over transition from the second excited 4+ state to the ground state in the isomeric decay of Pb^{204} was investigated, using a scintillation spectrometer with an absorber technique. The experimental transition probability of the 1.274-Mev E4 gamma ray was found to be approximately 1.3×10^2 sec^{-1} or less. A hindrance factor for this E4 transition was estimated to be at least about five. (auth)

7197 AN EXPERIMENTAL SURVEY OF NUCLEAR REACTIONS INDUCED BY 57 Mev PROTONS. PART I. Itaru Nonaka, Yoshio Saji, Arata Suzuki, Hisashi Yamaguchi, Robert Eisberg, Yoshihide Ishisaki, Ken Kikuchi, Kazuhisa Matsuda, Takashi Mikumo, and Yutaka Nakajima (Tokyo Univ.). J. Phys. Soc. Japan, 17: 1817-24(Dec. 1962). (In English)

Several targets, covering a wide range of mass number, are bombarded with a 57-Mev proton beam. Energy and angular distributions are measured for emitted protons. The experimental method and results are presented. The observed proton spectra are relatively structureless. However, the continuum proton spectra do have a pronounced angular dependence, which may be explained by the mechanism of direct collision of nucleons inside the nucleus and/or at the diffused rim of the nucleus. Excitation energies are determined for the few spectral peaks that are strongly excited at forward scattering angles. These peaks may be concerned with some collective excitations. (auth)

7198 INVESTIGATION OF THE REACTION $Be^9(n,p)Li^9$ BY MEANS OF NEUTRONS OF 14,81 Mev ENERGY. Gyoergyné Bornemisza. Magy. Tud. Akad. Atommag Kut. Int. (Debrecen) Kozlemen., 4: 79-92(Aug. 1962). (In Hungarian)

Tests are performed to detect the $Be^9(n,p)Li^9$ reaction by measuring the beta activity of the final nucleus on the one hand and delayed neutron emission on the other. In the first case, determination of the cross section as compared to the concurrent $Be^9(n,\alpha)He^6$ process yields an upper limit value of 4.11 mb for the (n,p) reaction. The measurement indicates the half life of He^6 to be 0.847 ± 0.011 sec. The cross section upper limit determined by means of the delayed neutron emission is 0.045 mb. (auth)

7199 ALPHA-RADIOACTIVITY OF MEDIUM HEAVY NUCLEI. Tibor Fényes. Magy. Tud. Akad. Atommag Kut. Int. (Debrecen) Kozlemen., 4: 97-104(Aug. 1962). (In Hungarian)

The energy liberated in alpha decay is found experimentally for nuclei at the bottom of the energy surface (i.e., for nuclei stable to β^+ decay). These data are obtained from experimental alpha energies and mass values. The quantum theory of alpha decay is used to approximate half

lives at various decay energies. The dependence of the total alpha-decay energy (alpha energy plus nuclear recoil energy plus screening correction) on neutron number is also shown. The relation of the half life to the total decay energy is displayed. (T.F.H.)

7200 NUCLEAR REACTIONS PRODUCED IN Li^6 TARGET NUCLEI BY MEANS OF PROTONS OF LOW ENERGY (0 TO 2 Mev). (SUMMARY REPORT). Imre Mahunka and Endre Somorjai. Magy. Tud. Akad. Atommag Kut. Int. (Debrecen) Kozlemen., 4: 105-11(Aug. 1962).

Calculated and measured Q values are given for reactions (p,α), (p,He^3), (p,γ), (p,n), (p,d), and proton elastic scattering on Li^6. Differential and total cross sections are measured for the (p,α) and (p,He^3) reactions and proton elastic scattering, and excitation functions and gamma yields are measured for the (p,γ) reaction. The experimental data are compared with several theoretical predictions. The low-lying energy levels of the intermediary Be^7 nucleus are derived. (T.F.H.)

7201 ISOMERISM OF Ir^{194}. P. F. Fettweis (Centre d'Étude de l'Energie Nucléaire, Mol, Belgium). Naturwissenschaften, 49: 389-90(1962). (In German)

The 47-sec isomer of Ir^{194} reported by Hennies and Flammersfeld was ascribed by other workers to impurities. A repeat of the experiment using BR-1 reactor neutrons gave results in very good agreement with Hennies and Flammersfeld. A study of the same reaction using enriched Ir^{191} and Ir^{193} showed no short-lived activity other than well established ones. It was concluded that the 47-sec activity should be ascribed to Rh. It was established that the 0.05 sec Ir^{194m} is the only isomer excited by neutron capture in the half-life period considered. (J.S.R.)

7202 HIGH ENERGY PHOTO-PROTONS FROM CARBON. Vastupal Parikh (Laboratoire de l'Accélérateur Linéaire, Orsay, France). Nucl. Phys., 38: 529-38 (Nov. 1962). (In English)

The proton spectrum resulting from the photo-disintegration and electro-disintegration of carbon is measured at 60°, employing the 150 Mev electron beam of the Orsay linear accelerator. The results are compared with the theoretical values based on the "quasi-deuteron" model and the direct γ-p interaction. (auth)

7203 E2 K CONVERSION COEFFICIENTS IN THE DECAY OF 13 y HALF-LIFE Eu^{152}. J. H. Hamilton, T. R. Duncan, H. Krouser, and J. Pollard (Vanderbilt Univ., Nashville). Nucl. Phys., 38: 539-52(Nov. 1962). (In English)

The K conversion coefficients of the $2^+ \rightarrow 0^+$, 344 kev transition in $_{64}Gd^{152}_{88}$ and the $4^+ \rightarrow 2^+$, 245 kev transition in $_{62}Sm^{152}_{90}$ from the decay of 13 y half-life Eu^{152} have been measured by the internal-external conversion method. The results are $\alpha_K = (285 \pm 15) \times 10^{-4}$ and $(91 \pm 14) \times 10^{-3}$ for the 344 and 245 kev transitions, respectively. These values are 8% lower and about 12% higher, respectively, than the theoretical E2 values. The theoretical value, however, falls within the limits of error of α_K of the 245 kev transition. The gamma-ray intensity of the 245 kev transition was found to be about 24% of the intensity of the 344 kev transition. The photoelectric cross section ratio τ_M/τ_N, ... for uranium was measured to be 2.6 ± 0.6 for $h\nu$ = 122 kev. (auth)

7204 FISSION CROSS SECTION AND FRAGMENT ANGULAR DISTRIBUTION FOR FAST NEUTRON-INDUCED FISSION OF U^{234}. R. W. Lamphere (Oak Ridge National Lab., Tenn.). Nucl. Phys., 38: 561-89(Nov. 1962). (In English)

The neutron-induced fission cross section for U^{234} has been measured to 4 Mev neutron energy. The angular distribution of the fission fragments has been investigated between bombarding energies of 0.4 and 3.8 Mev. The shape of the cross section curve is explained in terms of the suggestion of Wheeler, that neutron inelastic scattering competes with fission to an extent dependent in part on available levels in U^{234} for inelastic scattering. Levels above 790 kev are known to exist, and serve to depress the fission cross section between 850 and 1050 kev neutron energy. The shape of the angular distribution curve is analyzed in terms of Bohr's theory of fission through discrete levels of a collective nature thought to exist near saddle point. This analysis points to a K-band structure in the compound nucleus U^{235*} near the saddle point deformation of $\frac{1}{2}+$, $\frac{3}{2}-$, $\frac{1}{2}-$, with the ground levels of each band separated by the order of a few hundred kev. For neutron bombarding energies of 500, 850 and 1050 kev estimates are made of the extent to which each band contributes to fission. (auth)

7205 INELASTIC DIFFRACTION SCATTERING. E. V. Inopin and S. Shehata (Atomic Energy Establishment, Cairo). Nucl. Phys., 38: 590-6(Nov. 1962). (In English)

Asymptotic expressions are obtained for the cross sections for elastic diffraction scattering by a black nucleus. Similar expressions are derived for the case of inelastic scattering leading to excitation of collective states. The expressions are valid at $qR \gg 1$, $\beta \ll 1$ (q is the momentum transfer and β is the deformation parameter). (auth)

7206 INTRINSIC SYMMETRIES OF NUCLEAR ROTATIONAL STATES. J. Da Providencia (Universidade, Coimbra). Nucl. Phys., 38: 597-600(Nov. 1962). (In English)

One shows that it is possible to construct a density matrix $\hat{\rho}^{(0)}$ which satisfies the stationary Hartree-Fock equations and is invariant under three orthogonal reflections, either for an even-mass or an odd-mass nucleus. It follows that such a density matrix describes a nuclear state with zero angular momentum. The rotational motion of this state leads naturally, according to the Valatin-Thouless theory, to the definition of an inertia tensor which is symmetrical and therefore diagonalizable. (auth)

7207 NEUTRON-ALPHA REACTION IN INDIUM WITH 14 Mev NEUTRONS. B. Sen (Saha Inst. of Nuclear Physics, Calcutta). Nucl. Phys., 38: 601-6(Nov. 1962). (In English)

The energy and angular distributions of alpha particles from In, bombarded with 14 Mev neutrons, were obtained. Beyond 45°, the energy spectrum has been analyzed in terms of the evaporation model. Assuming $R = (1.4\ A^{1/3} + 1.2)$fm, the value of the nuclear temperature obtained on the basis of the continuum model is 0.78 Mev. The angular distribution of alphas in the 8-13 Mev region shows approximately a 90° symmetry. Alphas above 13 Mev are peaked in the forward direction. (auth)

7208 BRANCHING RATIO OF THE E2 TRANSITIONS IN DEFORMED EVEN NUCLEI AND THE EFFECTIVE POTENTIAL FOR VIBRATIONAL MOTIONS. Taro Tamura and Hiroshi Yoshida (Tokyo Univ. of Education). Nucl. Phys., 38: 616-22(Nov. 1962). (In English)

It is found possible to explain the unexpectedly large E2 transition probability between the β- and γ-vibrational states in deformed nuclei, recently observed by Nielsen, by treating the correlation of the β- and γ-vibrational motion in an appropriate way. Some discussion is made concerning the shape of the effective potential for these vibrational motions. (auth)

7209 SPECTROSCOPIC APPROACH TO THE DESCRIPTION OF THE INTERACTION OF FAST NUCLEONS WITH LIGHT NUCLEI. V. V. Balashov and A. N. Boyarkina (Moscow State Univ.). Nucl. Phys., 38: 627-37(Nov. 1962). (In English)

Interaction of fast nucleons with light nuclei is considered in the framework of impulse approximation. The "spectroscopic approach" based on the analysis of partial transitions, uniform for different nuclei and reactions, offers a natural way for taking into account the individual nuclear peculiarities due to which the cross sections and other characteristics of reactions vary widely from nucleus to nucleus. The reactions (p,2p) and (p,np) involving protons with energies from hundreds of Mev to several Bev are considered. Several experimental problems in low-energy physics are presented in connection with the spectroscopic properties of levels in the interaction of light nuclei with fast nucleons. Reactions involving high-energy particles with the participation of nucleon clusters in the nucleus are considered. (auth)

7210 SEARCH FOR TWO-QUANTUM DECAY OF In^{114m}. Z. Grabowski, S. Gustafsson, and G. Baeckstroem (Inst. of Physics, Uppsala). Nucl. Phys., 38: 648-53(Nov. 1962). (In English)

The 192 kev isomeric state in In^{114} decays with a half-life of 50 d. Measurements of the K/L ratio with a double focusing spectrometer confirmed that the transition to the ground state is of E4 character. The level might alternatively decay by two-quantum emission, which should be particularly probable in this case, since it may proceed by enhanced E2 transitions. Considering that the 192 kev E4 transition is strongly retarded, the In^{114m} case seems to be especially suitable for detection of two-quantum decay. This mode of decay was experimentally investigated by coincidence measurements between gamma rays of 96 kev and other gamma-rays, displayed on a multichannel analyzer. The result shows that the relative probability for two-quantum decay is less than $3 \cdot 10^{-5}$, a value which is orders of magnitude lower than theoretical estimates. Analogous experiments with conversion electrons might prove valuable. (auth)

7211 REACTION MATRIX THEORY FOR A FINITE NUCLEUS BY THE SEPARATION METHOD. H. S. Koehler (Inst. for Theoretical Physics, Uppsala). Nucl. Phys., 38: 661-85(Nov. 1962). (In English)

Binding energy, single particle energies and radius of O^{16} were calculated by the reaction matrix method. The single particle wave-functions were taken to be those of a harmonic oscillator. For the nucleon-nucleon potential we took a hard core repulsion of radius 0.4 fm and an exponential shaped attractive with intrinsic range 2.5 fm and infinite scattering length. We assumed this spin-independent potential to act only in s-states. The reaction matrix was calculated by the separation method. We obtained saturation at an r.m.s. radius of 2.74 fm and a binding energy of 3.4 Mev per nucleon. The experimental values are 2.58 fm and 8 Mev per nucleon. The above potential will give too little binding also for infinite nuclear matter, at somewhat too small density. The characteristic features of the reaction matrix are discussed and an approximate but explicit expression given. It is brought out that the correlation between two nucleons depends mainly on the states or potential energies of the two nucleons and is larger for two nucleons deep down in the Fermi sea than at the top. We conclude this would lead to peculiar properties of nuclear matter. With the total energy given in the reaction matrix approximation the variational method gives a shell model potential consisting of essentially three parts. One corresponds to the ordinary Hartree-Fock potential. Another has closely the same form as the Hartree-Fock potential and decreases the strength of this by about 15% for infinite nuclear matter of normal density. The weakest part is proportional to the square of the local density and is at normal density ≈ -1 Mev. The rearrangement energy for a nucleon at the top of the Fermi sea is thus obtained to be ≈ 8 Mev. The single particle energies of O^{16} come out in fair agreement with experiments. The rearrangement energy, usually neglected when calculating the reaction matrix, gives a correction of ≈ -1 Mev per nucleon in infinite nuclear matter and ≈ -0.1 Mev per nucleon for O^{16}. (auth)

7212 SURFACE ABSORPTION OF LOW-ENERGY NEUTRONS. H. Fiedeldey and W. E. Frahn (Univ. of Stellenbosch, Cape Province, S. Africa). Nucl. Phys., 38: 686-95(Nov. 1962). (In English)

An attempt is made to settle the question concerning the effects of surface absorption on the S-wave neutron strength function. Earlier arguments based on an analytic treatment of the S-wave scattering problem are extended and confirmed by numerical calculations of $\overline{\Gamma}_n^{(0)}/D$ and R'/R. It is shown (i) that surface concentration of the imaginary optical potential indeed results in qualitative changes in the behavior of the strength function, and (ii) that fairly large surface-to-volume absorption ratios are required in order to obtain over-all agreement with the experimental data of $\overline{\Gamma}_n^{(0)}/D$ in the mass number region $90 < A < 130$. (auth)

7213 THEORETICAL VALUES FOR MAGNETIC MOMENTS OF Mu-MESONIC ATOMS. Kenneth W. Ford (Brandeis Univ., Waltham, Mass.), Vernon W. Hughes, and John G. Wills. Phys. Rev., 129: 194-201(Jan. 1, 1963).

The magnetic moment of a negative muon bound in the field of a nucleus is slightly less than the moment of a free muon. The binding corrections to the moment have been calculated accurately for a number of nuclei, using realistic nuclear charge distributions. Polarization of the nucleus and of the atomic electrons by the muon also give rise to significant corrections to the muon moment. Precise determinations of the magnetic moment of heavy mu-mesonic atoms afford a way to test for possible structure of the muon which might be exhibited through the polarization of the muon in the strong electric field of the nucleus. The theoretical and experimental g values are in reasonably good agreement in view of the uncertainties about chemical and solid state magnetic shielding effects. (auth)

7214 REFERENCE SPECTRUM METHOD FOR NUCLEAR MATTER. H. A. Bethe, B. H. Brandow, and A. G. Petschek (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 129: 225-64(Jan. 1, 1963).

A new method is presented for the calculation of the reaction matrix G of the Brueckner-Goldstone theory. The spectrum of the intermediate states is replaced by a "reference spectrum" of the form $A + Bk^2$ where the constants A and B are chosen so as to approximate, as closely as possible, the actual particle energies for k between 3 and 6 F^{-1}. The reason for this choice is explained. With the reference spectrum, the Brueckner integral equation reduces to a differential equation which is easily solved. The case of a repulsive core can be solved explicitly, and can be summed over angular momentum, taking into account the correct statistical weights. If an attractive potential is added to the repulsive core, a simple "modified Born approximation" can be developed. Noncentral forces, such as tensor forces, are considered. The actual G matrix, G^N, is calculated from the reference matrix G^R. It is shown that

this can be done to sufficient accuracy (0.1 to 0.2 Mev per nucleon) by a simple quadrature. The difference $G^N - G^R$ arises mainly from the Pauli principle which is not taken into account in G^R. A small correction, less than 1 Mev per nucleon, arises from the inaccuracy of the reference spectrum. This shows that the details of the particle energy spectrum are not important for the calculation of the nuclear binding energy. The particle energy spectrum is carefully investigated. In agreement with Brueckner and Goldman, the G matrices determining the potential energy of states in the Fermi sea are calculated "on the energy shell," and a more detailed justification is given for this procedure. Those for states above the Fermi sea are calculated "off the energy shell." This, in combination with the repulsive core, has the consequence of making the potential energy very large and positive for large k, corresponding to an effective mass between 0.8 and 0.9 for highly excited states. In addition, there is an energy gap at the Fermi momentum, a feature which helps to justify the reference spectrum. A modified Moszkowski-Scott separation into short- and long-range potentials is developed and gives, in second order, results accurate to better than 0.1 Mev per particle. The wave functions of interacting particles are calculated in the reference spectrum approximation for central and tensor forces. (auth)

7215 THREE-NUCLEON CLUSTERS IN NUCLEAR MATTER. R. Rajaraman (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 129: 265-70(Jan. 1, 1963).

The effect of three-body clusters on the binding energy of nuclear matter is studied. An attempt is made to treat all such clusters of the third order as self-energy diagrams and to include their effect into the single-particle energies, thereby improving the convergence of the Goldstone expansion considerably. For this purpose, an expression for off-diagonal reaction matrix elements is derived. One of the consequences of this procedure is that, to a good approximation, the contribution of all the third-order diagrams together is equal to that arising from just the even "1" states of the simplest of these diagrams. Many of the arguments and approximations used are based on the previous paper of this issue by Bethe et al. (auth)

7216 NEW ISOTOPE In^{122}. J. Kantele and M. Karras (Univ. of Arkansas, Fayetteville). Phys. Rev., 129: 270-1 (Jan. 1, 1963).

A new isotope, In^{122}, has been produced by 14 to 15 Mev neutron bombardment of tin. The basis for mass and atomic number assignment is presented, as well as the following decay characteristics: half life, 7.5 ± 0.8 sec; beta end-point energy, 4.5 ± 0.8 Mev; two coincident gamma rays having energies 1.140 ± 0.010 Mev and 0.995 ± 0.010 Mev. (auth)

7217 (p,d) AND (p,t) REACTIONS ON B^{11}, C^{14}, O^{16}, AND O^{18}. James C. Legg (Princeton Univ., N. J.). Phys. Rev., 129: 272-82(Jan. 1, 1963). (PUC-1962-81)

Pickup (p,d) reactions on B^{11}, C^{14}, O^{16}, and O^{18} have been observed at proton energies ranging from 17.6 to 20 Mev. Also, (p,t) reactions on C^{14} and O^{18} were observed. Angular distributions were taken and absolute differential cross sections were obtained for all reactions except $C^{14}(p,d)C^{13}$ and $C^{14}(p,t)C^{12}$. The deuteron results were analyzed using the plane-wave Butler formalism and reduced widths and spectroscopic factors were calculated. The results indicate that the single-particle reduced width is a function of the binding energy of the transferred nucleon, which may indicate that the plane-wave approximation is not completely adequate for analyzing stripping and pickup experiments on light nuclei. The (p,t) results, when compared to those for the inverse (t,p) reactions, indicate that such experiments may possibly be described using a simple stripping formalism. (auth)

7218 BETA-GAMMA DIRECTIONAL CORRELATIONS IN Re^{186} AND Tm^{170}. Harry Dulaney, C. H. Braden, E. T. Patronis, Jr., and L. D. Wyly (Georgia Inst. of Tech., Atlanta). Phys. Rev., 129: 283-9(Jan. 1, 1963).

The beta-gamma directional correlations have been measured for the (934-kev beta) (137-kev gamma) cascade in Re^{186} and the (883-kev beta) (84-kev gamma) cascade in Tm^{170}. The coefficient A_2 varies from 0.035 at a beta energy of 220 kev to 0.095 at a beta energy of 830 kev in the case of Re^{186} and varies from −0.055 at a beta energy of 330 kev to −0.090 at a beta energy of 740 kev in the case of Tm^{170}. Interpretation of the decays in terms of limitations on the first forbidden beta decay matrix elements is discussed. For Re^{186} the directional correlation and the spectral shape correction can be fitted for values of the parameter $|\zeta_1|$ greater than 2. Rough agreement with the measurement of the beta-circularly polarized gamma correlation is also found. For Tm^{170} the directional correlation and an allowed spectral shape can be fitted for $\zeta_1 < -2$ and $\zeta_1 > 20$. (auth)

7219 PERTURBATION OF ALPHA PARTICLE—GAMMA RAY ANGULAR CORRELATIONS IN Am^{241}, Am^{243}, AND Cm^{243}. E. Flamm and F. Asaro (Univ. of California, Berkeley). Phys. Rev., 129: 290-6(Jan. 1, 1963). (UCRL 10199)

By utilization of the recoil properties associated with the alpha decay process, perturbations of alpha-gamma angular correlations in Am^{241}, Am^{243}, and Cm^{243} were observed in a variety of media including vacuum, metals, Mylar, oxides, and liquids. In the vacuum and Mylar environments the Am^{243} correlation is not only considerably more perturbed than in metallic environments but it exhibits an attenuation coefficient below the hard-core value for a static interaction. The perturbation in vacuum is attributed to a hyperfine structure interaction involving an electron shell excited in the alpha decay process. Several experiments designed to further explore the effect of alpha decay on the electron shell are suggested. It is pointed out that application of a strong magnetic field along the direction of one of the radiations may completely restore the correlation in vacuum. Improvement of the correlation in metals as compared to insulators may be related to the rapid recovery time of the electron shell in metallic media. (auth)

7220 NUCLEAR VIBRATIONS, ROTATIONS, AND THE SHELL MODEL. [PART] I. E. Flamm, C. A. Levinson, and S. Meshkov (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev., 129: 297-306(Jan. 1, 1963).

The relation between the shell model and the rotation-vibration model of nuclear structure is discussed. A method for reformulating the shell-model problem in terms of a vibrational-rotational Schrödinger equation is given. The two- and four-body problem in the sd shell is discussed in detail (auth)

7221 NUCLEAR VIBRATIONS, ROTATIONS, AND THE SHELL MODEL. [PART] II. Moshe Kugler (Israel Inst. of Tech., Haifa). Phys. Rev., 129: 307-11(Jan. 1,1963).

Within the s-d shell of the nucleus it is possible to approximate an interaction between particles having any given range by a sum of an extreme short-range interaction and an extreme long-range interaction. The long-range interaction is nearly equal to the P_2 interaction. This approximation is applied to the vibrational theory and it is shown that rotational spectra are predominant for all ranges of interaction. (auth)

7222 MAGNETIC ELASTIC SCATTERING OF ELECTRONS BY LIGHT NUCLEI. J. Goldemberg and Y. Torizuka (Stanford Univ., Calif.). Phys. Rev., 129: 312-15 (Jan. 1, 1963).

The elastic scattering of 41.5-Mev electrons was measured at ~180° where the charge scattering is very small so magnetic scattering stands out more clearly. Measurements were made for $_1H^1$, $_1D^2$, $_2He^4$, $_3Li^6$, $_3Li^7$, $_4Be^9$, $_5B^{10}$, $_5B^{11}$, $_6C^{12}$, $_7N^{14}$, $_8O^{16}$, $_9F^{19}$; $_{10}Ne^{20}$, $_{11}Na^{23}$, $_{12}Mg$, $_{13}Al^{27}$, $_{15}P^{31}$, $_{18}Ar^{40}$, $_{19}K^{39}$, and $_{20}Ca^{40}$. It is shown that the results are consistent with calculations based on scattering by the magnetic moment of the nuclei involved. (auth)

7223 BETA-GAMMA DIRECTIONAL CORRELATION IN Re^{188}. L. D. Wyly, C. H. Braden, and Harry Dulaney (Georgia Inst. of Tech., Atlanta). Phys. Rev., 129: 315-19 (Jan. 1, 1963).

The directional correlation between the 1960-kev beta group and the 155-kev gamma in the decay of Re^{188} has been measured. The coefficient A_2 is found to vary from about 0.17 to about 0.25 over the energy range W = 3 to W = 4.3. Limitations on the matrix elements for the sequence $1^-(\beta)2^+(\gamma)0^+$ are discussed. It is found that the directional correlation and a variety of beta spectral shapes may be fitted for values of the parameter $|\xi_1|$ greater than some minimum value which is dependent upon the spectral shape. Information is presented on further limitations of the matrix elements which will result when the shape is known and some discussion is given for the role of a measurement of the beta–circularly polarized gamma correlation. (auth)

7224 STUDY OF THE REACTIONS $F^{19}(\alpha,t)Ne^{20}$ AT 18.5 Mev AND $F^{19}(He^3,d)Ne^{20}$ AT 13.0 Mev. R. Jahr (Purdue Univ., Lafayette, Ind.). Phys. Rev., 129: 320-3(Jan. 1, 1963). (TID-16433)

Angular distributions from the $F^{19}(\alpha,t)Ne^{20}$ and $F^{19}(He^3,d)Ne^{20}$ reactions have been measured for the particle groups leaving Ne^{20} in its ground state and in its first excited state at 1.63 Mev. A direct interaction mechanism was indicated by the forward peaking and the oscillatory structure of all angular distributions. Butler's stripping theory was applied to the (He^3,d) data and the reduced widths obtained were compared with corresponding $F^{19}(d,n)Ne^{20}$ data. From comparison of the (He^3,d) and the (α,t) cross sections it is suggested that the $F^{19}(\alpha,t)Ne^{20}$ reaction does not proceed by a stripping mechanism. (auth)

7225 GYROMAGNETIC RATIO OF THE 2^+ STATE OF Os^{188}. G. Goldring, Drora Kedem, and Z. Vager (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev., 129: 337-8(Jan. 1, 1963).

The gyromagnetic ratio of the 2^+ state of Os^{188} of 155 kev excitation was measured by observing the precession in an external magnetic field of the angular distribution of the de-excitation gamma rays following Coulomb excitation with an atomic hydrogen beam. The mean life of the 2^+ state of Os^{188} was also measured by comparing the yield of gamma rays from this level to the yield of gamma rays from the 2^+ state in W^{184}. The mean life of the Os^{188} level was determined to be $\tau = 1.05 \pm 0.10$ nsec, in good agreement with recent direct measurements, and the gyromagnetic ratio was found to be $g = 0.20 \pm 0.02$. (auth)

7226 GAMMA-DECAY SCHEME OF THE 4.4-MIN Rh^{104m} ISOMER. R. C. Greenwood (Illinois Inst. of Tech., Chicago). Phys. Rev., 129: 339-44(Jan. 1, 1963).

The gamma-decay scheme of the 4.4-min Rh^{104m} isomer has been investigated using scintillation detectors and coincidence circuitry. In 96.2% of all decays, the principal decay mode from the 129-kev Rh^{104m} isomeric level has been found to be a 77-kev transition with E3 multipolarity to a 52-kev level, from which decay occurs to the ground state (with a 1+ spin and parity) by an E1 transition. A secondary decay mode (3.8% branching ratio) has been found to be from the 129-kev level to a 96-kev level by a highly converted M3 transition, from which decay occurs to the ground state by an M1 transition. An upper limit of 0.1% could be set on the possibility of a 44-kev transition from the 96-kev level to the 52-kev level. The K internal conversion coefficients of the 52- and the 77-kev transitions have been determined as $0.89^{+0.07}_{-0.09}$ and 17.9 ± 2.0, respectively, while an approximate (L + M + . . .)/K conversion ratio of 3.7 was obtained for the 33-kev transition. Spin and parity assignments of 5+, 2+, and 2– were made to the 129-, 96-, and 52-kev levels, respectively. The Rh^{104} ground state can be assigned as having a $[(g_{9/2})^5]_{9/2}(d_{5/2})^n$ shell-model configuration and, while the 129- and 96-kev levels can also probably be assigned this configuration, there is a possibility that either one, or both, of these states has a $(g_{9/2})^5(d_{5/2})^n$ configuration instead. The only reasonable configuration assignment for the 52-kev level is as a $(p_{3/2})(d_{5/2})^n$ state. (auth)

7227 LOW-ENERGY NUCLEAR LEVEL SCHEME OF Rh^{104}. R. C. Greenwood (Illinois Inst. of Tech., Chicago). Phys. Rev., 129: 345-52(Jan. 1, 1963).

Investigations of the low-energy level properties (level energies, spins, and parities) of Rh^{104} have been undertaken from studies of the coincidence relationships existing between the low-energy capture gamma rays produced by thermal neutron capture in Rh^{103} using a NaI(Tl) scintillation crystals as detectors. It is known from the decay scheme of the 4.4-min Rh^{104m} isomer that Rh^{104} has energy levels at 52, 96, and 129 kev with spins and parities of 2–, 2+, and 5+, respectively. The data obtained in these investigations have been combined with the isomeric level data in order to determine the properties of several additional levels. Additional levels in Rh^{104} have been determined at the following energies, with the level spin and parity in parenthesis after the energy; 184 kev (1±), 192 kev (3+), 269 kev (3±), 450 kev, and either 229 kev (3+) or 325 kev (4+). These spin and parity assignments were made on the basis of a K internal conversion coefficient analysis of the coincidence data together with consideration of the relative cascade intensities. On the basis of the possible odd-proton and odd-neutron configurations open to the 184- and 269-kev levels, and considering the transition intensities to the lower levels, it was determined that the negative-parity assignment is most probable for both of these levels, with the levels having configuration assignments of $(p_{3/2})(d_{5/2})$. The 192-kev level together with the 229- or 325-kev level most probably have either $[(g_{9/2})^5]_{9/2}(d_{5/2})^n$ or $(g_{9/2})^5(d_{5/2})^n$ configurations. In fact, if it is the 229-kev level which does exist, as the available evidence might seem to indicate, then, since they both have spins and parities of 3+, the 192-kev level would have one of these configurations while the 229-kev level would have the other. (auth)

7228 PROTON-OXYGEN DIFFERENTIAL SCATTERING CROSS SECTIONS. [PART] III. G. Hardie, R. L. Dangle, and L. D. Oppliger (Univ. of Wisconsin, Madison). Phys. Rev., 129: 353-61(Jan. 1, 1963). (TID-16342)

A thin gas target (~2.5 kev) was used to measure proton-oxygen elastic scattering cross sections in 2.5-kev steps at θ(c.m.) = 166°52′ for $8.5 \leq E_p \leq 13.6$ Mev. Similar data were then taken at seven other c.m. angles; 140°46′, 122°35′, 109°53′, 90°00′, 76°12′, 54°44′, and 28°08′ but with energy steps ranging from 5 kev to 25 kev. Detailed angular distributions of the elastic scattering were taken at roughly 0.5-Mev intervals throughout this energy range, the energies being chosen in order to avoid pronounced resonance

structure. In addition, angular distributions were taken at energies of 4.792, 5.870, and 7.009 Mev, in the region previously investigated by Salisbury. All the elastic scattering cross sections are of about 1.5% accuracy. $_6C^{16}(p,p_i)O^{16*}$ differential cross sections (good to ~10 to 15%) for $p_1 = p_1 + p_2$ and $p_1 = p_3 + p_4$ were measured at θ(lab) = 166°00′ and 86°24′. The 166°00′ inelastic data extend from 10.45 to 12.98 Mev with energy steps identical with the elastic data. The 86°24′ data for $p_1 + p_2$ extend from 8.5 to 11.7 Mev, while the $p_3 + p_4$ group was studied from 9.1 to 11.7 Mev. The positions and widths of 18 levels in F^{17} were obtained by inspection of the excitation curves. Two of these levels (E_x = 12.522 and 13.034 Mev) had widths of less than 5 kev. The elastic scattering angular distributions were analyzed using the optical model. Although quite good fits were found for the more forward angles, it was not possible to obtain agreement for θ(c.m.) > 136°00′. The extracted optical-model parameters are presented. (auth)

7229 NUCLEAR RESONANT SCATTERING OF GAMMA RADIATION OF VARIABLE ENERGY. W. L. Mouton, J. P. F. Sellschop, and G. Wiechers (Univ. of Witwatersrand, Johannesburg). Phys. Rev., 129: 361-4(Jan. 1, 1963).

A variable-energy gamma-ray system is described. Monoenergetic gamma radiation undergoing Compton scattering produced this energy variability over a significant range. The parameters of the system are described. Gamma radiation from a Co^{60} source of strength 1200 C was Compton scattered from a copper scatterer. The energy of the scattered radiation varies continuously from 1.33 Mev in the forward direction to 0.21 Mev at a scattering angle of 180°. The rays of mean energy 480 kev, corresponding to a mean scattering angle of 69.5°, were reasonantly scattered by lithium. From a self-absorption experiment the mean life of the first excited state of Li^7 was found to be $(1.48 \pm 0.35) \times 10^{-13}$ sec. (auth)

7230 RECOIL STUDY OF THE REACTION $Al^{27}(p,3pn)Na^{24}$. A. M. Poskanzer, J. B. Cumming, and R. Wolfgang (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 129: 374-84(Jan. 1, 1963). (BNL-6311)

In order to study the mechanism of a simple spallation reaction induced by Bev-energy protons, measurements were made of the momentum properties of Na^{24} nuclei produced from an aluminum target. Data were obtained on: (1) the fraction of Na^{24} nuclei recoiling out of targets thick with respect to the range of the recoils (the targets were oriented both perpendicular and parallel to the proton beam); (2) the distribution of Na^{24} ranges from a thin target measured with plastic catchers subtending an angle of 2π; (3) the angular distribution of the Na^{24} recoils with respect to the beam. Results of Monte Carlo knock-on cascade and evaporation calculations for 0.36- and 1.8-Bev bombarding energies are compared with the data in the laboratory system. The calculations predict sharper sideways peaking in the angular distributions, and more momentum deposition at the higher bombarding energy, than are observed. The experimental data are also reduced to a set of velocity vectors which is then interpreted in terms of a simple, constant-deposition-energy mechanism in which the incident proton makes only one quasi-elastic collision with a single nucleon which does not escape from the nucleus. This treatment accounts for most of the data but also predicts a much larger sideways peaking in the angular distribution than is observed. (auth)

7231 RANGE OF 1-3 Mev Ne^{22} IONS IN Al AND THE ANALYSIS OF SOME Na^{24} RECOIL DATA. A. M. Poskanzer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 129: 385-7(Jan. 1, 1963). (BNL-6312)

Beams of Ne^{22} ions from a Van de Graaff accelerator were stopped in stacks of aluminum leaf which were then analyzed for Ne content with a high-sensitivity mass spectrometer. The mean ranges projected along the beam direction for 1.0-, 2.0-, and 2.8-Mev Ne^{22} ions were found to be (0.35, 0.54, and 0.67) ± 0.02 mg/cm² of Al, respectively. The half-widths of the range curves were 0.20 ± 0.05 mg/cm². By interpolation with other data a range-energy curve for Na^{24} in Al was constructed. Existing data on the thick-target ranges of Na^{24} produced from Al by medium-energy protons, deuterons, and alpha particles were compared with the range-energy curve. The comparison indicated that partial momentum transfer for reactions leading to Na^{24} begins to occur for protons and alpha particles of bombarding energies of about 60 Mev. (auth)

7232 EVIDENCE OF NUCLEAR STRUCTURES FROM K^--MESON ABSORPTION. G. T. Condo and R. D. Hill (Univ. of Illinois, Urbana). Phys. Rev., 129: 388-99(Jan. 1, 1963).

The characteristics of the multinucleon capture of K^- mesons in nuclei have been investigated in both normal and water-soaked G5 nuclear emulsion. It has been found that the emission of fast (≤60 Mev) hyperons is more often associated with K^- captures in light (C,N,O) than in heavy (Ag,Br) nuclei. Further, considering the relative absorptions of Σ hyperons in the parent nucleus in which they are produced, we inferred that the rate of multinucleon K^- absorptions is approximately the same for all nuclei of nuclear emulsion and corresponds to ~17% of all K^- absorptions at rest. From those events which can be definitely assigned to interactions in light nuclei, by virtue of energy and momentum conservation, it was found that the reaction $K^- + (n,n) \rightarrow \Sigma^- + n$ is of comparable intensity with the reaction $K^- + (n,p) \rightarrow \Sigma^- + p$, and that in light nuclei, the major mode of multinucleon K^- absorption in C,N,O, appears to be on a pair of nucleons in an α-particle cluster. Comparison of the characteristics of the K^- multinucleon absorptions in light and heavy nuclei shows that α-particle clusters are less likely to be involved in (Ag,Br) than in (C,N,O). An attempt to estimate the nuclear pair correlation function was also made. (auth)

7233 ENERGY DEPENDENCE OF PRODUCT YIELDS IN COPPER SPALLATION BY PROTONS BETWEEN 3 AND 30 Gev. J. Hudis, I. Dostrovsky, G. Friedlander, J. R. Grover, N. T. Porile, L. P. Remsberg, R. W. Stoenner, and S. Tanaka (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 129: 434-7(Jan. 1, 1963). (BNL-6286)

Careful comparisons of cross sections for formation of 19 products of copper spallation by 3- and 30-Bev protons indicate only a small energy dependence in this energy range. As the energy is increased from 3 to 30 Bev, products of Ar > 40 decrease in yield by 15% or less, except for some highly neutron-deficient species, while low-mass products increase in yield by 10 to 50%. These findings are somewhat at variance with earlier reports from CERN. (auth)

7234 SOLID STATE AND NUCLEAR RESULTS FROM A MÖSSBAUER-TYPE STUDY OF Au^{197}. Louis D. Roberts (Oak Ridge National Lab., Tenn.) and J. O. Thomson. Phys. Rev., 129: 664-73(Jan. 15, 1963).

Through the measurement of the hfs of dilute alloys of gold with iron, cobalt, and nickel, the magnetic moment of the first excited state of Au^{197} has been measured as +0.38 ± 0.08 nm. It was found that the hfs coupling constant in the alloys is closely proportional to the magnetic moment of the ferromagnetic metal. The value of the effective hyperfine field for the iron alloy is H′ = (1.46 ± 0.16) × 10^6 gauss. A study of the isomer shift of the gold-

nickel alloy system as it relates to ferromagnetism is presented. The recoilless absorption linewidth as a function of absorber thickness for metallic gold is given. The half-life of the first excited state of Au^{197} is found to be $T_{\frac{1}{2}} = (1.93 \pm 0.2) \times 10^{-9}$ sec. (auth)

7235 OPTICAL-MODEL ANALYSIS OF ELASTIC SCATTERING OF PROTONS ON OXYGEN AT INTERMEDIATE ENERGIES. C. B. Duke (Princeton Univ., N. J.). Phys. Rev., 129: 681-91(Jan. 15, 1963). (PUC-1962-75)

Differential cross sections and polarizations for the elastic scattering of protons by oxygen at bombarding energies between 8.66 and 19.2 Mev have been analyzed using the diffuse-surface optical model of the nucleus. The best fits to the experimental data were obtained by a least-squares procedure. Excellent fits to the experimental differential cross sections were obtained over almost the entire region, although resonance structures in the cross sections required a rapid variation of the parameters with energy. The presence of a thin absorptive shell and small volume absorption is the outstanding feature of the optical potential. A Thomas spin-orbit term did not satisfactorily reproduce the experimental polarizations. (auth)

7236 THRESHOLD EFFECTS IN AVERAGE CROSS SECTIONS ACCORDING TO R-MATRIX THEORY. W. E. Meyerhof (Stanford Univ., Calif.). Phys. Rev., 129: 692-702(Jan. 15, 1963).

This paper attempts to place on a firm basis certain expressions for effects in elastic and total cross sections caused by, and in the neighborhood of, a reaction threshold. Explicit expressions are derived for the collision matrix near a reaction threshold. These expressions are based on the R-matrix theory of nuclear reactions and extend slightly work by Wigner and by Breit on threshold effects. The expressions are quite general, allowing for the presence of compound resonances. Both the channel matrix and the level matrix formulations of R-matrix theory are used. The former turns out to be convenient for formulating the general expressions of the collision matrix and the cross sections. The latter is more convenient for performing energy averages. It is shown that certain formulas for energy-averaged total and elastic cross sections, which were made plausible in a previous paper by the author, follow from the above-mentioned general expressions by performing suitable energy averages. Consequences of the random-sign approximation of the "value quantities" γ_λ and of a partial breakdown of this assumption are examined and related to the assumptions of the optical model. It is shown that under the assumption of random signs, the total cross section should show no threshold effects, whereas if this assumption is relaxed threshold effects appear. Hence it is, in principle, possible to decide by experiment which situation obtains. Finally, cross section threshold effects under the single-level approximation are given; with a slight generalization of the phase shift, these are identical to expressions derived by Baz and by Newton. (auth)

7237 ISOMERIC TRANSITION IN SAMARIUM-143. W. L. Alford and D. R. Koehler (Army Missile Command, Redstone Arsenal, Ala). Phys. Rev., 129: 703-?(Jan. 15, 1963).

Samarium oxide enriched in Sm^{144} has been bombarded by 14-Mev neutrons to produce the isomeric state of Sm^{143}. The isomeric state was found to decay with a half-life of 65 ± 3 sec by the emission of a 0.75 ± 0.01-Mev gamma ray. Measured relative to a $Cu^{63}(n,2n)Cu^{62}$ cross section of 610 mb, a value of 1670 ± 400 mb was found for the total (n,2n) cross section of Sm^{144}. The ratio of the cross section for production of the isomeric state to the total (n,2n) cross section was determined to be approximately 0.5. (auth)

7238 PHOTODISINTEGRATION OF HELIUM. M. L. Rustgi and S. N. Mukherjee (Banaras Hindu Univ., Varanasi, India). Phys Rev., 129: 717-19(Jan. 15, 1963).

The electric dipole bremsstrahlung-weighted cross section σ_b and integrated cross section σ_{int} for the photodisintegration of helium have been calculated using the modified Irving wave function. Good agreement has been obtained with the current experiment values: $\sigma_b = 2.4 \pm 0.15$ mb and $\sigma_{int} = 95 \pm 7$ Mev mb. The results have also been compared with the recent calculations of Goldhammer and Valk. (auth)

7239 $C^{13}(d,n)N^{14}$ AND $O^{18}(d,n)F^{19}$ DIFFERENTIAL CROSS SECTIONS AT 3.9-Mev BOMBARDING ENERGY. R. E. Benenson and B. Yaramis (Columbia Univ., New York). Phys. Rev., 129: 720-6(Jan. 15, 1963).

The $C^{13}(d,n)N^{14}$ reaction has been restudied with the purpose of obtaining differential cross sections. The intention has been to extract stripping reduced widths for the four lowest energy levels in N^{14} and to investigate an anomalous angular distribution from previous work on this reaction. A table of θ^2, the reduced widths for stripping, is given along with a brief discussion of the consistency of the N^{14} shell-model assignments with the stripping analysis. The second experiment on the $O^{18}(d,n)F^{19}$ reaction was based on the suggestion that neutrons which leave F^{19} in its 2.78-Mev level might be undergoing spin-flip stripping. A more strongly forward angular distribution than an $L_p = 2$ distribution was found; this L_p value had been suggested if the 2.78-Mev level had a $7/2+$ assignment and spin-flip stripping is an important mechanism. Since the experiment was completed, evidence has appeared which favors a few low spin value for the 2.78-Mev level and invalidates the reaction as an indicator of the spin-flip mechanism. (auth)

7240 SHELL MODEL STUDY OF Mn^{55}. Ervin H. Schwarcz (Univ. of California, Livermore). Phys. Rev., 129: 727-32(Jan. 15, 1963). (UCRL-6404(Rev.1))

A shell model calculation for Mn^{55} is carried out which includes interactions among all neutrons and protons not in closed shells. It is shown that the inclusion of the neutron-proton interactions gives good agreement with the experimental data for several sets of exchange parameters and reasonable values of the two-particle force range. The magnetic moment and quadrupole moment are also calculated and are in satisfactory agreement with experiment. (auth)

7241 NEUTRONS FROM D + T AND D + H. C. H. Poppe, C. H. Holbrow, and R. R. Borchers (Univ. of Wisconsin, Madison). Phys. Rev., 129: 733-9(Jan. 15, 1963).

Continuous neutron spectra produced by bombarding T and H with deuterons have been measured using time-of-flight spectrometry for a wide range of deuteron bombarding energies and neutron emission angles. The observed spectra for the D + T interaction exhibit two maxima, one occurring at a neutron energy slightly below the maximum possible energy of neutrons from deuteron breakup and the other occurring several Mev lower. The high energy peak is interpreted as arising from monoenergetic neutrons which leave He^4 in an excited state at 20 Mev. For the D + H interaction the observed spectra exhibit no structure. (auth)

7242 ELEMENTS IN REGION OF PLATINUM FORMED BY FUSION IN FISSION EXPLOSIONS. L. Marshall (New York Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 129: 740-3(Jan. 15, 1963).

The fission products in a fission explosion at the time of

the last few generations before explosion are sufficiently numerous that the probability of reaction with each other becomes measurable. In this paper the probability of fusion is calculated. It is found that the fusion of two light fission fragments is the only possible process of this type. For explosion of a mass of 14 kg of uranium or plutonium having a 25% efficiency the yield of platinum group elements is estimated as 1.2×10^{14} atoms. Although the kind of nucleus produced instantaneously with highest probability has Z = 75 and A = 190, the excess of kinetic energy is such as to boil off between 9 and 18 neutrons forming elements A = 175 to 182, on the low side of the stability curve. In view of the recently developed theories of supernovae explosion, involving production of Cf^{254} and other fissile nuclei, it may be important to consider the subsequent fusion of fission fragments in supernovae. If this process is sufficiently important, it may affect the astrophysical abundances of elements in the region of platinum. (auth)

7243 ELASTIC AND INELASTIC SCATTERING OF 31.1-Mev PROTONS BY CARBON-12. J. Kirk Dickens, David A. Haner, and Charles N. Waddell (Univ. of Southern California, Los Angeles). Phys. Rev., 129: 743-53(Jan. 15, 1963).

The angular distributions of 31.1-Mev protons scattered by the ground state and the 4.4-, 7.7-, 9.6-, 12.7-, 14.0-, 15.1-, and 16.1-Mev excited states have been measured. The differential cross sections for the elastic scattering have been analyzed using the diffuse-surface optical model of the nucleus for a wide range of parameters. This analysis indicates that at this energy the best fit requires a potential characterized by volume, as well as surface, absorption. The angular distributions of the inelastically scattered protons are peaked forward and have been compared to predictions of direct interaction theories. (auth)

7244 AVERAGE RESONANCE PARAMETERS AND THE OPTICAL MODEL. P. A. Moldauer (Argonne National Lab., Ill.). Phys. Rev., 129: 754-6(Jan. 15, 1963). (TID-17138)

Averages over resonances of the elements of the collision matrix are derived from R-matrix theory for the general many-channel case. Of special interest are the average diagonal elements because of their relation to the complex phase shifts of optical models for the channels. In the absence of correlations among channel width amplitudes, the formula relating an average diagonal element to average resonance parameters is found to be the same as obtained by Thomas for the single-channel case, or when competing channels have small transmission factors. The evaluation of this formula with the aid of the single-particle level picture of Lane, Thomas, and Wigner is discussed, as well as the effect of correlations among channels which are indicative of direct reaction effects. (auth)

7245 LIFETIMES OF THE 246- AND 46.7-kev TRANSITIONS IN Po^{210}. E. G. Funk, Jr., H. J. Prask, F. Schima, J. McNulty, and J. W. Mihelich (Univ. of Notre Dame, Ind.). Phys. Rev., 129: 757-9(Jan. 15, 1963).

The half lives of the 1431- and 1478-kev levels in Po^{210} have been measured, the experimental values being 1.8 ± 0.2 nsec and 29 ± 6 nsec, respectively. These levels are depopulated by E2 transitions of 246 and 46.7 kev whose probabilities are approximately three times greater than the single particle estimates. (auth)

7246 POLARIZATION AND ANGULAR DISTRIBUTION MEASUREMENTS ON THE NEUTRONS FROM THE $Be^9(p,n)B^9$ REACTION. C. A. Kelsey, G. P. Lietz, S. F. Trevino, and S. E. Darden (Univ. of Notre Dame, Ind.). Phys. Rev., 129: 759-64(Jan. 15, 1963).

The polarization of the neutrons from the $Be^9(p,n)B^9$ reaction has been measured for laboratory emission angles of 30°, 50°, 70°, and 90°, for proton bombarding energies of 2.4, 2.75, 3.35, and 3.7 Mev. Angular distributions of the neutrons from this reaction have also been measured for nine proton bombarding energies between 2.5 and 4.1 Mev. For the polarization measurements, neutrons were scattered from analyzers of magnesium, oxygen, and carbon, and the asymmetries in the scattering were measured with the aid of an electromagnet which could rotate the polarization vector of the neutrons between the source and the scatterer. In detecting the neutrons, energy discrimination was employed to eliminate the effect of the three-body-breakup neutrons. The polarization is very small at 2.4 Mev, and at the higher energies is positive (Basel convention) at 30°, small at 50°, and negative at 70° and 90°. The largest value of the polarization found was 0.29 ± 0.04 at an emission angle of 30° and a bombarding energy of 3.7 Mev. Above 3.0-Mev proton energy the angular distributions show a broad maximum in the backward direction. Calculations of the cross section and polarization were made assuming the reaction involves only three levels in the compound nucleus. Although partially successful in reproducing the polarization data, these calculations were unable to reproduce the measured cross sections. (auth)

7247 PROTON GROUPS FROM THE $S^{33}(d,p)S^{34}$ REACTION. M. W. Brenner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev., 129: 765-8(Jan. 15, 1963). (TID-16664)

Natural and 25% enriched sulfur targets sandwiched between two silver layers were bombarded with deuterons accelerated in the MIT-ONR electrostatic accelerator to an energy of 6.0 Mev. Proton groups from the (d,p) reactions were observed at angles 90, 50, and 20 degrees to the deuteron beam with a broad-range magnetic spectrograph. Twenty-three proton groups corresponding to levels in S^{34} were observed. The ground-state Q value of the $S^{33}(d,p)S^{34}$ reaction was measured as 9.193 ± 0.010 Mev. (auth)

7248 YIELD RATIOS OF ISOMERS PRODUCED BY NEUTRON ACTIVATION. Bernard Keisch (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev., 129: 769-75 (Jan. 15, 1963).

Values of the yield ratios of 14 pairs of isomers ($Co^{60,60m}$, $Zn^{69,69m}$, $Se^{81,81m}$, $Br^{80,80m}$, $Rb^{86,86m}$, $Rh^{104,104m}$, $Ag^{110,110m}$, $In^{114,114m}$, $Sb^{122,122m}$, $Te^{127,127m}$, $Cs^{134,134m}$, $Eu^{152,152m}$, and $Ir^{192,192m}$) produced by thermal neutron activation are given. The values are compared with those calculated by the method of Huizenga and Vandenbosch. From this comparison, the spins of several compound nuclei are indicated. Comparison of isomer yield ratios measured with thermal and with epi-cadmium neutrons are given for 7 pairs ($Rh^{104,104m}$, $In^{114,114m}$, $In^{116,116m}$, $Cs^{134,134m}$, $Eu^{152,152m}$, $Ta^{182,182m}$, and $Ir^{192,192m}$). These are discussed in terms of the spins of the compound nucleus which are associated with different neutron absorption resonances. New thermal neutron cross-section values are given for the formation of 9 nuclides (Co^{60m}, Rb^{86m}, Rb^{86}, Ag^{110}, In^{114m}, In^{114}, Ir^{192m}, Ir^{192}, and Ir^{194}). (auth)

7249 PROPERTIES OF FINITE NUCLEI. K. S. Materson, Jr. (Univ. of California, San Diego, La Jolla) and A. M. Lockett. Phys. Rev., 129: 776-85(Jan. 15, 1963).

The properties of Pb^{208} have been determined, using the Brueckner-Gammel-Weitzner theory of finite nuclei. Self-consistent solutions of the Hartree-Fock equations as modified by Brueckner and Goldman have been obtained. The properties computed include binding energy, mean proton and neutron radii, separation energies, spin-orbit split-

tings, nonlocal and state-dependent single-particle potentials, surface depth of density and potentials, and the potential-density relation. Semiquantitative agreement with experiment is obtained, the maximum difference between theory and experiment being of the order of 15%. Revised computations for Ca^{40} are reported to permit comparison between the results (with an improved treatment of the rearrangement energy) and those previously reported by Brueckner, Lockett, and Rotenberg for O^{16}, Ca^{40}, and Zr^{90}. (auth)

7250 $He^3 + \underline{t}$ REACTIONS. Darryl B. Smith, Nelson Jarmie, and A. M. Lockett (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 129: 785-90(Jan. 15, 1963). (LADC-5338)

The energy distributions of alpha particles and of protons from the $He^3 + \underline{t}$ reactions have been measured for 1.9-Mev incident tritons at laboratory angles of 30° for alphas, and both 30° and 90° for protons. Absolute cross sections are obtained. The spectra are discussed in terms of a model which assumes that uncorrelated three-body breakup and several two-stage processes all contribute independently to the cross section. The calculations based on this model are in excellent agreement with the observed spectral shapes. The neutron-proton correlation corresponding to the unbound singlet state of the deuteron is observed. The binding energy of He^5 (for breakup into a neutron and an alpha particle) was found to be $\epsilon = -0.79 \pm 0.03$ Mev. (auth)

7251 ABSOLUTE CROSS SECTIONS AND ANGULAR DISTRIBUTIONS FOR CHARGED PARTICLES FROM LITHIUM–LITHIUM NUCLEAR REACTIONS. M. N. Huberman, M. Kamegai, and G. C. Morrison (Univ. of Chicago). Phys. Rev., 129: 791-802(Jan. 15, 1963).

Angular distributions in the barycentric coordinate system are presented for 24 charged-particle emissions from Li^7Li^7, Li^7Li^6, and Li^6Li^6 interactions. These have been integrated, and the resulting total cross sections are tabulated. The total cross-section sums for a given projectile target combination are in reasonable agreement with theoretical estimates based on barrier penetration with nuclear radii given by $r_0A^{1/3}$ with $r_0 = 1.5$ F. The largest total cross sections measured are approximately 40×10^{-28} cm^2. The angular distributions from Li^6Li^6 and Li^7Li^7 are symmetrical about 90° by necessity, those from Li^7Li^6 are, in general, asymmetric and difficult to reconcile with a simple compound-nucleus interpretation of the reactions. Most of the intense particle emissions are cases in which the residual nucleus can be formed by Li^7 capturing a deuteron or an alpha from Li^6, or by Li^6 capturing an alpha from Li^7. To produce high cross sections these captures must be with $l = 0$ between the reacting clusters. The evidence supports the hypothesis that a prominent but not necessarily exclusive reaction mechanism is for one of the Li-Li reacting partners to be distorted into "reacting clusters," consisting of an α cluster from either of the lithiums, and a deuteron cluster from Li^6 or a triton cluster from Li^7. (auth)

7252 NUCLEAR REACTIONS INDUCED BY THE NITROGEN BOMBARDMENT OF BORON-11, FLUORINE, ALUMINUM, SILICON, PHOSPHORUS, AND CHLORINE. E. Newman and K. S. Toth (Oak Ridge National Lab., Tenn.). Phys. Rev., 129: 802-7(Jan. 15, 1963).

Cross sections as a function of bombarding energy were obtained from thick target yields for twelve reactions induced by 27.5-Mev nitrogen ions accelerated in the ORNL 63-in. Cyclotron. Materials containing the following six elements were bombarded: boron, fluorine, aluminum, silicon, phosphorus, and chlorine. The irradiated materials were γ counted and the radioactive products were identified by their characteristic γ rays and half lives. The following nuclides were observed: Ne^{23} from B^{11}; P^{30} from F^{19}; K^{38} from Al^{27}; Cl^{34m} and K^{38} from silicon; Sc^{43} from P^{31}; Sc^{43}, Sc^{44}, Sc^{44m}, Ti^{45}, and V^{47} from Cl^{35}; and Cr^{49} from Cl^{37}. The observed cross sections are in general agreement with those obtained from other heavy-ion induced reactions at these energies. For the target nucleus Cl^{35} it was possible to identify five products, and experimental cross-section ratios were compared to the theoretical ratios determined from Monte Carlo evaporation calculations. (auth)

7253 NUCLEAR E1 PEAK SPLITTING. D. C. Peaslee (Australian National Univ., Canberra). Phys. Rev., 129: 808-15(Jan. 15, 1963).

A schematic calculation is given for the splitting of the E1 giant resonance into (two) component peaks, taking into account the large collective energy shift. The observed intensity ratio of about 1 : 2 between the main peaks of O^{16} is calculated for the first time by assuming the quadrupole-quadrupole component of effective two-body forces in the nucleus to be enhanced by almost a factor 2 over the value given by a local potential of Yukawa shape. Similar calculations show this assumption to be compatible with the additional salient features of C^{12} and C^{13} photodisintegration, such as the "pygmy" resonance. These three nuclei are then simply generalized to serve as typical examples of the closed shell, closed shell minus a few particles, and closed shell plus a few particles. Detailed consideration of highly deformed nuclei by this method looks prohibitively laborious in detail but should generally yield the hydrodynamic intensity ratio of 1 : 2. The approach emphasizes that the peak splitting for such nuclei is a function of the E1 excited state rather than of the ground state. (auth)

7254 POSITRON DECAY OF Y^{88}. J. I. Rhode, O. E. Johnson, and W. G. Smith (Purdue Univ., Lafayette, Ind.). Phys. Rev., 129: 815-20(Jan. 15, 1963).

The weak positron spectrum in the decay of Y^{88} has been investigated using a 4π-positron-scintillation spectrometer. Two measurements of the spectrum yield experimental shape factors which are consistent above 250 kev with that expected for a unique once-forbidden transition. The average end-point energy obtained in these two measurements is 761 ± 9 kev. The positron branching was measured and found to be 0.20 ± 0.01%. The log ft is 9.4, and log f_1t is 8.7. On the basis of recent measurements of the gamma-ray intensities in the Y^{88} decay the electron capture branching to the 1840-kev level is determined to be 5.8 ± 0.7%, which yields an electron capture to positron ratio of 29 ± 4 for this transition. (auth)

7255 APPLICATIONS OF POLOLOGY TO STRIPPING REACTIONS. C. Dullemond (Univ. of Rochester, N. Y.) and H. J. Schnitzer. Phys. Rev., 129: 821-6(Jan. 15, 1963).

A model-independent definition for a reduced width in nuclear reactions is proposed. In particular, stripping reactions of the form A(d,p)B are studied. The applicability of pology techniques for the determination of absolute reduced widths is tested by means of a computer experiment. The results indicate that the extrapolation to the pole can give a model-independent value for the reduced width which is accurate to at least an order of magnitude. It is likely that increased accuracy is possible if such model-dependent features as the bound-state wave function are included in the extrapolation formula. (auth)

7256 LIFETIMES OF THE LOW-ENERGY M1 TRANSITIONS IN La^{137} AND Kr^{83}. S. L. Ruby, Y. Hazoni, and M. Pasternak (Atomic Energy Commission, Rehovoth, Israel). Phys. Rev., 129: 826-8(Jan. 15, 1963).

Using conventional time to pulse-height techniques, the lifetimes of the low-lying levels in La^{137} and Kr^{83} have been measured, despite the low γ-ray energies (10 and 9.3 kev) and the large internal conversion coefficients (130 and 11). The results of 89 ± 4 and 147 ± 4 nsec, respectively, correspond to retardation factors of 370 and 45 over the single-particle model predictions for those M1 transitions. (auth)

7257 1.57-Mev STATE IN Mo^{94}. C. W. Reich, R. P. Schuman, and R. L. Heath (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev., 129: 829-35(Jan. 15, 1963).

In an attempt to make an unambiguous spin assignment to the 1.57-Mev state in Mo^{94} the gamma radiation following the decay of 20,000-yr Nb^{94} and 6.6-min Nb^{94m} has been studied. In the decay of the former activity, an upper limit of ≈0.03% has been placed on the intensity of a 1.57-Mev crossover transition relative to that of the cascade transition. This was obtained from a comparison of calculations of the coincidence summing effect in NaI(Tl) crystals with the observed variation of the intensity of the 1.57-Mev peak with source-detector distance. It has been found that approximately 0.2% of the decays of the 6.6-min state in Nb^{94} are by beta emission to the 872-kev state in Mo^{94}. Evidence for the existence of a beta branch from the 6.6-min state in Nb^{94} to the 1.57-Mev state in Mo^{94} is presented. The intensity of this branch, relative to that feeding the 872-kev state, is approximately 1%. The directional correlation of the 703–872-kev gamma-ray cascade de-exciting the 1.57-Mev state has been measured. The results of this measurement are consistent with a spin-4 assignment to this state, or a spin-2 assignment with $\delta \approx -0.2$ for the 703-kev transition. Arguments favoring the former assignment are presented. On the basis of a spin-4 assignment, consistent spins are assigned to the two states in Nb^{94}. Several possible configurations for the low-lying states in Nb^{94} are briefly discussed. (auth)

7258 DEUTERONS FROM HIGH-ENERGY PROTON BOMBARDMENT OF MATTER. S. T. Butler and C. A. Pearson (Univ. of Sydney). Phys. Rev., 129: 836-42 (Jan. 15, 1963).

The results of a process of formation of high-energy deuterons from targets exposed to 25 to 30 Bev proton beams are evaluated. The formation mechanism involves the pairing of a neutron and proton from the cascade of nucleons which develops within the struck nucleus. The interactions responsible for the deuteron formation are firstly the average nuclear interaction seen by the cascade nucleons within the nucleus, and secondly the normal neutron-proton interaction. A magnitude of 25 Mev for the modulus of the real and imaginary nuclear potentials is sufficient to ensure good agreement with experiment for all energies of the outgoing deuterons and for all emerging angles. (auth)

7259 PRODUCTION OF TRITONS, DEUTERONS, NUCLEONS, AND MESONS BY 30-Gev PROTONS ON Al, Be, AND Fe TARGETS. A. Schwarzschild and Č. Zupančič (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 129: 854-62(Jan. 15, 1963). (BNL-6303)

The momentum spectra of particles emerging at 30° to a 30-Bev proton beam impinging upon various targets were measured using time-of-flight techniques. Intensities of protons, antiprotons, π mesons, K mesons, deuterons, and tritons in the range 1 to 3 Bev/c are given. Particular attention is given to the tritons and deuterons emitted from the different targets. Possible mechanisms for their production are discussed. (auth)

7260 NUCLEAR MANY-BODY PROBLEM WITH NONUNIFORM DENSITY. I. THEORY. D. S. Koltun and L. Wilets (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev., 129: 880-8(Jan. 15, 1963).

The many-body problem for nuclear matter is considered under the constraint that the density of the system vary periodically in space; this is equivalent to the problem of an external periodic potential. The method of Martin, Schwinger, and Puff is employed to derive, through second order in the amplitude of the density ripple, a set of tractable equations for the energy of the system. No new approximations are needed beyond those already assumed for the uniform density case. The model exhibits some interesting complications of the finite nuclear problem, and yet possesses sufficient simplicity for solubility. In the long-wave-length limit, an expression obtains for the explicit dependence of the energy on the density gradient; this relationship is useful in a study of the nuclear surface problem. Numerical calculations are planned. (auth)

7261 DETECTION OF NUCLEAR DISINTEGRATIONS PRODUCED BY 1.55-Bev PROTONS IN SILVER CHLORIDE SINGLE CRYSTALS. Charles B. Childs and Lawrence Slifkin (Univ. of North Carolina, Chapel Hill). Phys. Rev. Letters, 9: 354-5(Oct. 15, 1962).

A technique that makes tracks of heavy primary cosmic rays visible in transparent silver chloride single crystals is shown to be applicable to the study of nuclear disintegrations produced by particles accelerated in high-energy machines. Tracks of events produced by a 1.55 Bev proton beam are presented and discussed. Events observed include hammer tracks, collision-produced particles with ranges greater than 1800 microns, and events thought to be decays of Be^8 into two alpha particles. (H.D.R.)

7262 INVESTIGATION OF THE $^{24}Mg(\alpha,\gamma)^{28}Si$ REACTION AND OF SOME $^{27}Al(p,\gamma)^{28}Si$ RESONANCES. P. J. M. Smulders and P. M. Endt (Rijksuniversiteit, Utrecht). Physica, 28: 1093-1115(Nov. 1962). (In English)

The yield of 8 to 13 Mev γ radiation from the $Mg^{24}(\alpha,\gamma)Si^{28}$ reaction is measured in the E_α = 1.2 to 3.2 Mev range, making use of natural Mg and enriched Mg^{24} targets. Twenty resonances are observed, corresponding to Si^{28} levels in the 11.3 to 12.8 Mev region. Six resonances show a relatively strong ground-state transition (γ_0); the spin and parity (either 1^-, or 2^+) of these resonances is uniquely determined through angular distribution measurements. At nine other resonances the angular distribution of γ_1, the transition to the Si^{28} first-excited state at 1.77 Mev, was measured; along with angular correlation measurements in several different geometries, this measurement uniquely determines the J^π of these resonances. The remaining five resonances are weak. The strongest resonances have $J^\pi = 2^+$ or 4^+. These are deexcited through E2 or strongly mixed M1 – E2 transitions. In both the $Mg^{24}(\alpha,\gamma)Si^{28}$ and $Al^{27}(p,\gamma)Si^{28}$ reactions a level in Si^{28} at 12.24 Mev is excited. The (unique) spin determinations from these reactions, however, do not agree, yielding $J^\pi = 4^+$ and $J^\pi = 3^+$, respectively. Although the γ-ray single spectra are closely analogous, pronounced differences exist in the γ–γ coincidence spectra measured from the two reactions, showing that actually two closely spaced ($\Delta E \approx 0.6$ kev) levels in Si^{28} are excited. An extremely weak resonance in the $Al^{27}(p,\gamma)Si^{28}$ reaction is observed at $E_p = 202.3 \pm 0.9$ kev. The data obtained from the $Mg^{24}(\alpha,\gamma)Si^{28}$ reaction are compared with the information from the $Al^{27}(p,\gamma)Si^{28}$ and $Al^{27}(p,\alpha)Mg^{24}$ reactions. From the measured yields of these three reactions, the partial widths Γ_α, Γ_p, and Γ_γ are computed for most resonance levels. (auth)

7263 EXCITATION PROCESSES IN HELIUM AND POLARIZATION OF THE RESULTING LIGHT INDUCED BY PROTON IMPACT (5-35 kev). J. Van Eck, F. J.

De Heer, and J. Kistemaker (FOM-Laboratorium voor Massascheiding, Amsterdam). Physica, 28: 1184-90(Nov. 1962). (In English)

Absolute excitation cross sections in proton-helium collisions are determined by measuring n $^1S \rightarrow 2\ ^1P$ and n $^1D \rightarrow 2\ ^1P$ transitions of the He I spectrum and n $^3F \rightarrow 3\ ^3D$ transitions of the He II spectrum. The excitation cross sections of the n ^1D levels show maxima as a function of the energy. It is found that the emitted light is polarized in the n $^1D \rightarrow 2^1P$ He I transitions. (auth)

7264 ACCURATE MEASUREMENT OF THE HALF LIFE OF THE 91 kev STATE OF 147 PROMETHIUM. H. Beckhuis (Rijksuniversiteit, Groningen, Netherlands). Physica, 28: 1199-1200(Nov. 1962). (In English)

The half life of the 91-kev state of Pm^{147} is measured as (2.59 ± 0.02) nsec. The Pm^{147} is produced in the beta decay of Nd^{147}, and the half life is found by determining the time lag between the beta particle and the L conversion electrons produced in the decay of the 91-kev state. The error quoted is the estimated probable error. (T.F.H.)

7265 INELASTIC SCATTERING OF HIGH ENERGY NUCLEONS BY NUCLEI AND IMPULSE APPROXIMATION. Yoshihiko Nishida (Saga Univ., Japan). Prog. Theoret. Phys. (Kyoto), 28: 564-6(Sept. 1962).

Inelastic scattering of high energy nucleons by nuclei is an important tool to investigate properties of nuclear levels. It is shown that a test regarding the impulse approximation can be performed. The inelastic scattering of 182 Mev protons by C^{12} with energy losses of 4.43, 7.66, and 9.63 Mev is investigated. (W.D.M.)

7266 A SEMI-CLASSICAL OPTICAL MODEL FOR THE SCATTERING OF HIGH ENERGY NEUTRONS BY NUCLEI. Carlos Alberto Heras (Comisión Nacional de Energía Atómica, Buenos Aires). Rev. Union Mat. Arg., 19: 338-48(1962). (In Spanish)

An exact expression for the elastic scattering cross section is derived under the assumptions of the "black" nucleus model, and the validity of the Fraunhofer diffraction formulas which approximate that expression is discussed. A semiclassical correction is introduced to take into account the partial transparency of the nucleus and it is seen that it allows a better agreement with experimental data on the scattering of 84-Mev neutrons by Al, Cu, and Pb. It also allows the determination of the optical parameters of the nucleus which coincide with those determined with the (quantum) nuclear optical model. (auth)

7267 PULSE METHOD OF PRODUCING ABSOLUTE POLARIZATION OF MAGNETIC NUCLEI. U. Kh. Kopvillem and R. V. Shubina (Kazan Branch, Academy of Sciences, USSR). Soviet Phys.-Solid State (English Transl.), 4: 1260-6(Jan. 1963).

Schrödinger's equation has been solved for a nuclear and electron spin system including simultaneous or successive action of two pulsed magnetic or supersonic fields. Formulas have been obtained describing the initital amplitude of the signal from the electron and nuclear free induction and the magnetic polarization. Two new pulse methods are given for polarizing the nuclei in diamagnetic and paramagnetic crystals, which make it possible to polarize the nuclear spin system completely at helium temperatures. The new method differs from the usual stationary polarization method in that it is independent of the relaxation mechanism and makes possible a study of the unstable excited states of magnetic nuclei. A list of substances is given suitable for polarizing Cr, Fe, and Mn nuclei. (auth)

7268 CONCERNING THE POSITIVE SECONDARY EMISSION FROM GRAPHITE, COPPER, AND GOLD ON BOMBARDMENT BY NOBLE GAS IONS WITH ENERGIES 100 AND 30,000 ev. V. Walther and H. Hintenberger (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 17a: 1034-5(Nov. 1962). (In German)

Reactions of He^+, Ne^+, Ar^+, Kr^+, and Xe^+ at 100 to 30,000 ev with platelets of graphite, Cu and Au were studied. Yields of secondary positive ions from these reactions and their dependence on the energy of the rare gas ions and on target temperature were determined. (M.C.G.)

7269 EFFECTIVE CROSS SECTION FOR E0 TRANSITIONS IN INELASTIC ELECTRON AND POSITRON SCATTERING BY ATOMIC NUCLEI. Rudolf Rodenberg (Universität, Frankfurt am Main). Z. Naturforsch., 17a: 1036-7(Nov. 1962). (In German)

An equation was derived for the effective cross section for E0 transitions in electron and positron scattering by nuclei. (M.C.G.)

7270 THE g_R FACTOR OF THE 2^+ ROTATION LEVEL OF Er^{168}. E. Bodenstedt, H. J. Koerner, E. Gerdau, J. Radeloff, L. Mayer, K. Auerbach, J. Braunsfurth, and G. Mielken (Universität Hamburg). Z. Physik, 170: 355-66(1962). (In German)

The rotation of the angular correlation between the γ group at about 820 kev and the 80-kev radiation in the decay of Tm^{168} was observed in an external magnetic field of 20300 gauss. The result $\omega_R \cdot \tau = 0.485 \pm 0.051$, yields for the g_R-factor of the 80 kev state of Er^{168}: $g_R = +0.25 \pm 0.03$. The evaluation includes a paramagnetic correction factor of: $\beta = 7.26$, ($B_{eff} = \beta \cdot B_{ext}$). The angular correlation is slightly attenuated by internal fields. For a liquid source of $Tm(NO_3)_3$ solved in 3n HNO_3, a measurement of the differential angular correlation as a function of the delay time gave: $\lambda_2 = (5.8 \pm 2.9) \cdot 10^7\ sec^{-1}$, assuming $A_2(t) = A_2(0) \cdot e^{-\lambda_2 \tau_1}$. The half life of the 80 kev state was found to be: $T_{\frac{1}{2}} = (1.92 \pm 0.04) \cdot 10^{-9}$ sec in agreement with earlier measurements. (auth)

7271 MEASUREMENT OF THE PROTON POLARIZATION IN THE REACTION $C^{12}(d,p)C^{13}$ FOR DEUTERON ENERGIES BETWEEN 0.8 AND 1.2 Mev. C. Weddigen (Technische Hochschule, Karlsruhe, Ger. and Kernforschungszentrums Karlsruhe, Ger.). Z. Physik, 170: 436-47(1962). (In German)

The energy dependence of the proton polarization P was measured for a fixed reaction angle of 52 degrees by p-He^4 elastic scattering. P varied rapidly with the deuteron energy E_d. The experimental results are in good agreement with the assumption of a $J^\pi = 1^-$ level of the compound nucleus N^{14} at 11.23 Mev (E_d = 1.13 Mev). (auth)

7272 THE REACTION $Li^7(p,\alpha)He^4$ WITH POLARIZED PROTONS FOR PROTON ENERGIES BETWEEN 1 AND 3.2 Mev. C. Weddigen (Technische Hochschule, Karlsruhe, Ger. and Kernforschungszentrums Karlsruhe, Ger.). Z. Physik, 170: 448-54(1962). (In German)

The reaction $Li^7(p,\alpha)He^4$ was investigated with polarized protons using the reaction $C^{12}(d,p)C^{13}$ as a proton polarizer. The right-left asymmetry R under 45 degrees was found to be less than 0.5. The case R = 0 for all proton energies is not excluded. (auth)

7273 THE NEUTRON CAPTURE SPECTRUM OF Sm^{150}. Erhard Bieber, Till [von] Egidy, and Otto W. B. Schult (Technische Hochschule, Munich). Z. Physik, 170: 465-74(1962). (In German)

The internal conversion electrons and the gamma rays emitted by samarium after neutron capture were measured by means of a beta spectrometer and a bent-crystal spectrometer. Lines corresponding to 50 transitions between 59 kev and 1.7 Mev were found with the beta spectrometer.

The measurement with the crystal spectrometer showed 11 lines between 250 kev and 740 kev. The multipolarity of a few lines was determined. A level scheme containing most of the measured lines is suggested. (auth)

7274 CHECK OF THE FORM OF THE MUON ABSORPTION EXCHANGE EFFECT AND THE INFLUENCE OF NUCLEAR STRUCTURE ON MUON ABSORPTION WITH THE HELP OF TOTAL ABSORPTION RATES FOR Cl^{35} AND Cl^{37}. Hans Georg Wahsweiler (Universität, Freiburg i. B.). Z. Physik, 170: 475-506(1962). (In German)

Using the shell model of nuclei the total muon absorption rates in Cl^{35} and Cl^{37} were calculated. This calculation yields the right "isotope effect" in the absorption of muons by chlorine (whereas Primakoff's theory in which a homogeneous nuclear matter model is assumed predicts an incorrect value). As the energy, being transferred to the absorbing nucleus, does not essentially exceed 10 Mev, only the protons outside the $_8O^{16}$-core will contribute to the absorption by Cl^{37}. The calculation was done including and omitting the "weak magnetic interaction" and for positive and negative sign of pseudoscalar coupling. The theoretical prediction $(C_P/C_A) > 0$ was confirmed by comparison of the computed absorption rates in Cl^{37} with experiment, but the "conserved vector current" hypothesis could not be checked. (auth)

7275 THE NUCLEAR QUADRUPOLE MOMENT OF Mn^{55}. H. Walther (Universität, Heidelberg). Z. Physik, 170: 507-25(1962). (In German)

With a recording photoelectric Fabry-Perot spectrometer and an atomic-beam light source the hyperfine structure of the Mn I-resonance lines $\lambda = 4031$ Å, $\lambda = 4033$ Å, $\lambda = 4034$ Å ($3d^5 4s^2 a^6S_{5/2} - 3d^5 4s4pz^6P^0_{7/2,5/2,3/2}$) and of the intercombination lines $\lambda = 5395$ Å and $\lambda = 5433$ Å ($3d^5 4s^2 a^6S_{5/2} - 3d^5 4s4pz^8P^0_{7/2,5/2}$) was measured. Furthermore the resonance lines were measured with a pulsed atomic-beam in absorption. In this case the quotient $(I_0(\nu) - I(\nu))/I_0(\nu)$ was recorded, where $I(\nu) = I_0(\nu) \exp(-\alpha(\nu)d)$ was the observed intensity with absorption and $I_0(\nu)$ the intensity of the light source. From the hyperfine structure splitting the value of the electric quadrupole moment of Mn^{55} was derived to be: $Q(Mn^{55}) = +(0.35 \pm 0.05) \times 10^{-24}$ cm^2. (auth)

7276 FORMATION OF At^{209} AND At^{207} ISOTOPES IN THE BOMBARDMENT OF Bi AND Pb WITH HIGH-ENERGY PROTONS. B. N. Belyaev, N. S. Maltseva, V. N. Mekhedov, Namg-Pug Ming, and R. A. Szymczak (Shimchak) (Joint Inst. of Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1129-34(Oct. 1962). (In Russian)

The yields are determined for the isotopes At^{209} and At^{207} with respect to the yield of At^{211} in the bombardment of bismuth and lead with protons of energy 120 to 660 Mev. Separation of the astatine was conducted chemically, while the relative yields were established from α-particle spectra measured by means of a grid ionization chamber. The ratios of yields of At^{209} and At^{211} under irradiation of bismuth by 120 and 660 Mev protons were 0.64 ± 0.06 and 0.72 ± 0.06, respectively, whereas the ratios of yields of At^{207} and At^{211} are 0.30 ± 0.03 and 0.51 ± 0.04. Bombardment of lead with 200 and 660 Mev protons and also with 400 Mev deuterons gave ratios of yields of At^{209} and At^{211} of 1.31 ± 0.28; 1.43 ± 0.43, and 1.52 ± 0.25, whereas the ratios of yields of At^{207} and At^{211} are 0.28 ± 0.07; 0.61 ± 0.13, and 0.52 ± 0.15. The formation of the foregoing isotopes of astatine is regarded as the resultant of secondary capture reactions of superbarrier nuclei He^3, He^4, and Li obtained in multiple interactions of nucleons at high energies. (auth)

7277 FINE STRUCTURE OF THE Pu^{239} α-RADIATION. S. A. Baranov, V. M. Kulakov, and S. N. Belenkii. Zh. Eksperim. i Teor. Fiz., 43: 1135-9(Oct. 1962). (In Russian)

The results of investigation of the radioactive decay of Pu^{239} carried out with a magnetic α-spectrograph are presented. An analysis of the Pu^{239} spectrum revealed the existence of more than 20 fine-structure α-groups most of which have been detected for the first time. A possible interpretation on the energy levels of the U^{235} nucleus which indicates the existence of a new level band based on the $5/2^+$ orbit is discussed. The U^{235} energy level scheme is presented. (auth)

7278 POLARIZATION OF γ-RAYS FROM THE REACTION $Si^{30}(p,\gamma)P^{31}$. P. M. Tutakin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i. Teor. Fiz., 43: 1140-5(Oct. 1962). (In Russian)

Photographic emulsions impregnated with heavy water are used to measure the plane polarization of γ rays from the reaction $Si^{30}(p,\gamma)P^{31}$. For energies $E_p = 773$, 939, and 979.5 kev, a study is made of transitions from resonance levels to the ground level of the nucleus $P^{31}(3/2^+ \rightarrow 1/2^+)$. The coefficients of the mixture δ for different types of transitions came out, respectively, to -2.3, -0.15, and -1.6. For the energy $E_p = 1393$ kev, a study is made of the transition to the first excited level 1.26 Mev ($3/2^+$). Spin and parity of the resonance level came out to $1/2^+$, and $\delta = 0.02$. (auth)

7279 THE KINETIC ENERGY OF FRAGMENTS AS A FUNCTION OF α-PARTICLE ENERGY IN THE TERNARY FISSION OF URANIUM. Z. I. Soloveva and R. A. Filov. Zh. Eksperim. i Teor. Fiz., 43: 1146-8(Oct. 1962). (In Russian)

A study is made of the dependence of the over-all range of fragments in the ternary fission of uranium by thermal neutrons upon the energy of long-range α particles. The data obtained serve as a basis for a discussion of the mechanism of ternary fission. (auth)

7280 PHOTONEUTRONS FROM In^{115}. E. S. Anashkina (Ioffe Inst. of Physics and Tech., Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1197-1201(Oct. 1962). (In Russian)

The energy and angular distributions of photoneutrons from In^{115} are obtained in irradiation by γ bremsstrahlung at $E_{\gamma\,max} = 28$ Mev. The contribution of resonance photoeffect came out to $(45 \pm 10)\%$. The angular distribution of photoneutrons in the range 1.0 to 11.0 Mev is anisotropic. The total yield of photoneutrons in the energy range 0 to 11.0 Mev is $(1.72 \pm 0.6) \times 10^{-3}$ neutrons/mole · Mev · cm^2. (auth)

7281 QUADRUPOLE INTERACTION AND ISOMERIC SHIFTS OF 23.8 kev γ-TRANSITION OF Sn^{119} NUCLEUS IN ORGANO-TIN COMPOUNDS. A. Yu. Aleksandrov, N. N. Delyagin, K. P. Mitrofanov, L. S. Polak, and V. S. Shpinel (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1242-7(Oct. 1962). (In Russian)

Measurements are made of the spectra of resonance absorption of a γ-transition of Sn^{119} of energy 23.8 kev in organotin compounds $(C_4H_9)_2SnX_2$ (X is a halogen atom), $(C_4H_9)_2SnO$, $(C_4H_9)_2SnS$, $(C_4H_9)_2SnSO_4$, and $(C_4H_9)_2SnSO_3$, and also in the compounds $(C_4H_9)_4Sn$, $SnCl_4$, and $SnBr_4$. The magnitudes are determined of the constants of quadrupole interaction for a 23.8-kev excited state of the Sn^{119} nucleus, and the magnitudes of isomeric shifts of a 23.8-kev γ-transition in the foregoing compounds (relative to the transition energy in tin dioxide). It is shown that these magnitudes vary regularly for compounds of type $(C_4H_9)_2$

SnX_2 and SnX_4 when the electronegativity of the X atom varies. The magnitude of the electric field gradient on a tin nucleus is found to be influenced by double bonds in molecules and also by atoms with high electronegativity that are not directly connected with the tin atom. A possible qualitative interpretation of the observed regularities is discussed. (auth)

7282 ON REACTIONS OF TOTAL DECAY OF NUCLEI. Yu. A. Berezhnoi, A. P. Klyucharev, Yu. N. Ranyuk, and N. Ya. Rutkevich. Zh. Eksperim. i Teor. Fiz., 43: 1248-52(Oct. 1962). (In Russian)

A study is made of the reaction of total decay of colliding carbon nuclei into α particles ($C^{12} + C^{12} \rightarrow 6\alpha$); this reaction occurs under the irradiation of nuclear emulsions with carbon ions of energy 115 Mev. The angular and energy distributions of α particles and the excitation function are compared with the calculated values obtained from the statistical model of direct nuclear decay. (auth)

7283 MEASURING THE LIFETIME OF THE LEVEL 4^+ (1282 kev) OF Cd^{114} BY THE METHOD OF RESONANCE SCATTERING. A. F. Akkerman, E. Ya. Vilkoviskii, D. K. Kaipov, and V. N. Chekanov (Inst. of Nuclear Physics, Academy of Sciences, Kazakh SSR). Zh. Eksperim. i Teor. Fiz., 43: 1268-71(Oct. 1962). (In Russian)

The lifetime of the level 4^+ (1282 kev) of Cd^{114} is found by means of a model of elastic collisions of molecules and the experimentally measured dependence of the cross section of the resonance effect upon the density of the source. The lifetime obtained, $\tau_2 = (7.5^{+1}_{-2}\,^{2}_{6}) \times 10^{-12}$ sec, is compared with calculated magnitudes obtained from a variety of nuclear models. At the same time, the method of self-absorption was used to find the lifetime of the level 2^+ (557 kev) of Cd^{114}, $(1.53 \pm 0.53) \times 10^{-11}$ sec, in agreement with other experimental data. (auth)

7284 STATISTICAL NUCLEAR MODEL WITH CORRELATIONS ACCOUNTED FOR. G. M. Vagradov and D. A. Kirzhnits (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1301-7(Oct. 1962). (In Russian)

The constants are calculated that enter into the Weizsäcker formula for the binding energy of an atomic nucleus. In order to take correlations into account, use is made of the gas approximation with altered law of dispersion of nucleons. The inhomogeneity effects are accounted for in the Thomas–Fermi approximation (heavy nuclei). Agreement is obtained with the empirical values of the coefficients. (auth)

7285 MEASUREMENT OF $\gamma\gamma$-COINCIDENCES IN THE $Ag^{107}(n,\gamma)Ag^{108}$ REACTION. I. V. Estulin, L. F. Kalinkin, and A. S. Melioranskii (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1378-84(Oct. 1962). (In Russian)

A double-crystal luminescent spectrometer is employed for measuring $\gamma\gamma$ coincidences in the $Ag^{107}(n,\gamma)Ag^{108}$ reaction. The energies and intensities of γ lines in the range up to 640 kev are determined. The energy level scheme of Ag^{108} with excitation energies up to 720 kev and the transitions between them are discussed. (auth)

7286 POLARIZATION OF PROTONS IN STRIPPING REACTIONS ON LIGHT AND MEDIUM NUCLEI. M. V. Pasechnik, L. S. Saltykov, and D. I. Tambovtsev. Zh. Eksperim. i Teor. Fiz., 43: 1575-8(Nov. 1962). (In Russian)

Experimental results of an investigation of the polarization effect in stripping reactions are presented for light and medium nuclei. The deuteron energy is 13.8 Mev. Angular dependences of proton polarization are obtained for Be^9, B^{10}, and Ca^{40} target nuclei and angles from 10 to 70°. The polarization is measured at small angles for Si^{28} and the two isotopes Ni^{58} and Ni^{60}. (auth)

7287 DETERMINATION OF THE SPIN OF Eu^{152m}. V. M. Lobashov, V. A. Nazarenko, and L. F. Sayenko (Ioffee Inst. of Physics, Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1579-81(Nov. 1962). (In Russian)

The $\beta\gamma$ correlation between the β-electron momentum and γ-quantum circular polarization in the allowed branch of the Eu^{152m} β decay with an end point β-electron energy of 560 kev and relative intensity 1.2% is measured. The correlation coefficient $A_1 = +(0.40 \pm 0.10)$ indicates that a spin and parity 1^- should be assigned to the Eu^{152m} isomeric state instead of the previously accepted value 0^-. (auth)

7288 DISINTEGRATION OF THE C^{12} NUCLEUS INTO THREE α-PARTICLES AS A RESULT OF INELASTIC SCATTERING OF 80 Mev π^+-MESONS. V. I. Bogatin, Z. Novak, and V. I. Ostroumov (Leningrad Polytechnic Inst.). Zh. Eksperim. i Teor. Fiz., 43: 1582-91(Nov. 1962). (In Russian)

The disintegration of the C^{12} nucleus into three α particles as a result of inelastic scattering of 80-Mev π^+ mesons is studied by the photographic emulsion technique. Excitation of C^{12} nuclei to the 9.63-Mev level is found to contribute considerably to the cross section of the reaction (~20%). From the observed angular correlation of the decay products it is concluded that the spin of this level exceeds 1. The experimental data on the energy distribution of the α particles can be explained by assuming simultaneous breakup of the C^{12} nucleus into three α particles with resonance interaction between the particles in the final state. (auth)

7289 CROSS SECTIONS FOR PHOTOPROTON REACTIONS IN LEAD. Yu. I. Sorokin, V. G. Shevchenko, and B. A. Yurev (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1600-3(Nov. 1962). (In Russian)

The total yield curves for the (γ,p) reactions on Pb^{207} and Pb^{208} and the (γ,pn) and (γ,d) reactions on Pb^{208} are measured by recording the induced activity. The energy dependence of the total cross section which shows a maximum at 26.5 Mev (6.2 mb) is determined from the yield curve. The contribution of the (γ,pn) and (γ,d) reactions to the total cross section is discussed, and the curve for the (γ,p) cross section which has a maximum at 26.0 Mev (5.7 mb) is separated. The integral cross sections for the complete reactions and the (γ,p) reactions which respectively equal 60 and 55 Mev · mb are not inconsistent with the estimates made by the summation rule for quadrupole transitions. (auth)

7290 CASCADE COULOMB EXCITATION OF ROTATIONAL LEVELS WITH 4^+ AND 6^+ SPINS. O. F. Afonin, Yu. P. Gangrskii, I. Kh. Lemberg, and V. A. Nabichvrishvili (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1604-10(Nov. 1962). (In Russian)

Cascade Coulomb excitation of rotational levels of the Sm, Gd, Er, and W isotopes was studied. Targets enriched with isotopes of the indicated elements were bombarded with 50-Mev N^{14} ions from a cyclotron. Coincidences of γ quanta emitted as a result of Coulomb excitation and inelastically scattered ions were recorded. The ions were recorded with a p-n silicon detector. Cascade coulomb excitation of rotational levels with a spin and parity 4^+ was observed in Sm^{154}, Gd^{154}, Gd^{156}, Gd^{158}, Gd^{160}, Er^{164}, Er^{166}, Er^{168}, Er^{170}, W^{182}, W^{184}, and W^{186} nuclei and rotational levels with spin and parity 6^+ in Sm^{154} and Gd^{160} nuclei. The results are compared with the theory of cascade Coulomb

excitation developed by Alder and Winter. For most of the nuclei the agreement with the theory is good. The tungsten and Gd^{154} isotopes are exceptions, the observed yield being smaller than that calculated from the theory. (auth)

7291 ENERGY DISTRIBUTIONS OF PHOTOFISSION FRAGMENTS FROM U^{238} NUCLEI FOR VARIOUS PEAK γ-QUANTUM BREMSSTRAHLUNG ENERGIES. B. A. Bochagov, A. P. Komar, and G. E. Solyakin (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1611-15(Nov. 1962). (In Russian)

The bremsstrahlung spectrum with $E_{\gamma max}$ = 17.5, 30, and 50 Mev from a synchrotron was used for obtaining contour diagrams of the distribution of kinetic energy of U^{238} photofission fragments. A double ionization chamber was used as detector of the fragments. It is found that the kinetic energy of fragments emitted in symmetric fission is constant within 3 Mev when the mean excitation energy of the fissioning nuclei changes. (auth)

7292 LIFETIMES OF THE EXCITED STATES OF DEFORMED Dy^{160}, Lu^{175}, Hf^{177} AND Ir^{191} NUCLEI. E. E. Berlovich, Yu. K. Gusev, V. V. Ilyin, and M. K. Nikitin (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1625-35(Nov. 1962). (In Russian)

Lifetimes of levels of deformed Dy^{160}, Lu^{175}, Hf^{177}, and Ir^{191} nuclei are determined. The half lives of the 86.5, 283, and 966 kev Dy^{160} levels are, respectively, $(1.7 \pm 0.1) \times 10^{-9}$ sec, $(7.1 \pm 0.9) \times 10^{-11}$ sec, and $\leq 7 \times 10^{-12}$ sec; for the 113 and 321 kev Hf^{177} levels the lifetimes are $(4.2 \pm 0.3) \times 10^{-10}$ sec and $(6.9 \pm 0.3) \times 10^{-10}$ sec; for the 114 and 396 kev Lu^{175} levels: $(1.1 \pm 0.1) \times 10^{-10}$ sec and $(3.25 \pm 0.10) \times 10^{-9}$ sec; for the 129.6 kev Ir^{191} level: $(8.1 \pm 1.6) \times 10^{-11}$ sec. The experimental results are compared with predictions of the generalized model of the nucleus. The intrinsic quadrupole moments and g-factors of the nuclei are derived. The collective motion g-factor for the Ir^{161} nucleus located at the upper boundary of the deformation region was found to be much greater than that of the Hf^{177} and Lu^{175} nuclei located in the middle of the deformation region. Retardation factors for single particle El transitions to the ground levels of the Hf^{177} and Lu^{175} nuclei relative to those computed by the Nielson formula are respectively f_H = 650 and f_H = 105 The probabilities for transition to rotational levels of ground state bands for these nuclei are close to the theoretical values. (auth)

7293 ANGULAR ANISOTROPY OF THE γ-QUANTA ACCOMPANYING U^{235} FISSION. M. V. Blinov, N. M. Kazarinov, A. N. Protopopov, and B. M. Shiryaev. Zh. Eksperim. i Teor. Fiz., 43: 1644-8(Nov. 1962). (In Russian)

The angular anisotropy of γ-radiation emitted in fission of U^{235} induced by thermal neutrons is determined. It is found that $(12 \pm 2)\%$ more γ-quanta are emitted in the direction of movement of the fragments than in the perpendicular direction. (auth)

7294 DECAY OF SOME MILLISECOND ISOMERS. V. V. Remaev, Yu. S. Korda, A. P. Klucharev, and A. M. Smirnov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1649-52 (Nov. 1962). (In Russian)

Isomer states of Ge^{71}, Y^{88}, Nb^{90}, and Pm^{141} nuclei were obtained in nuclear reactions with targets irradiated with ~20-Mev protons. Energy spectra of the isomeric γ decay and of internal conversion electrons were measured. The total internal conversion coefficient was determined for all investigated isomers. A more exact value of the half-life for the isomeric state of the Nb^{90} nucleus is obtained. Possible decay schemes are discussed on basis of the data obtained. (auth)

7295 EMISSION OF FAST DEUTERONS IN THE PHOTODISINTEGRATION OF O^{16}. A. P. Komar, A. V. Kulikov, V. P. Chizhov, I. P. Yavor, and Yu. M. Volkov (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1657-9(Nov. 1962). (In Russian)

The relative yields of photonuclear reactions involving the emission of fast deuterons are determined. It is found that the deuterons are emitted as a result of complex photodisintegrations with the emission of at least one more particle besides the deuteron. Most of the deuteron yield is due to the $O^{16}(\gamma,dp)C^{13}$ and $O^{16}(\gamma,dn)N^{13}$ reactions. An angular correlation between the directions of emission of the deuterons and accompanying nucleons with energies E > 2 Mev in the $O^{16}(\gamma,dp)C^{13}$ and $O^{16}(\gamma,dn)N^{13}$ reactions is detected. (auth)

7296 INVESTIGATION OF THE $C^{12}(t,p)C^{14}$ REACTION. B. Kuhn, V. I. Salatskii, and I. V. Sizov (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1660-4(Nov. 1962). (In Russian)

The differential cross sections of the reaction $C^{12}(t,p)C^{14}$ for the ground state of the residual C^{14} nucleus are measured with an electrostatic generator for accelerating the tritium ions. The measurements are carried out at an angle of 90° (in the laboratory system) for tritium energies between 0.32 and 1.18 Mev. For some of the energies in this range the proton angular distributions are also measured of angles between 0 and 155° in the l. s. Total reaction cross sections are obtained for tritium ion energies between 0.37 and 1.16 Mev. (auth)

7297 INVESTIGATION OF NUCLEAR REACTIONS OF THE (p,xn) AND (p,2pxn) TYPE ON SEPARATED TELLURIUM ISOTOPES. N. G. Zaitseva, M. Ya. Kuznetsova, Ming Namg Puk, and V. A. Khalkin (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1672-7(Nov. 1962). (In Russian)

A radiochemical study of the excitation functions of reactions of the (p,xn) and (p,2pxn) type is carried out on separated tellurium isotopes (Te^{125} and Te^{122}) at bombarding proton energies between 120 and 660 Mev. It is found that with growth of the energy from 120 to 300 Mev the cross section for reactions of the type (p,xn), $1 \leq x \leq 4$ appreciably decreases and then, within the experimental errors, remains constant when the energy increases to 660 Mev. Within the experimental errors the cross sections for (p,2pxn) $1 \leq x \leq 6$ reactions remain constant throughout the investigated energy range. The cross section of the (p,2p) reaction is practically constant for energies between 120 and 480 Mev and at 660 Mev increases by approximately 1.5 times. (auth)

7298 EQUILIBRIUM FIGURES AND FISSION OF A ROTATING NUCLEUS. G. A. Pik-Pichak. Zh. Eksperim. i Teor. Fiz., 43: 1701-8(Nov. 1962). (In Russian)

The relief of the total energy-surface of a rotating nucleus is studied in the zero ellipsoidal approximation within the framework of the liquid-drop model of the nucleus. It is found that for a fission parameter $x = x_0 = 0.81$ the total energy surface relief significantly changes; for $x < x_0$ a new stable equilibrium position may arise in which the nucleus is not axially symmetric. The range of values of x in which the fission pattern of a rotating nucleus previously studied may occur is determined. It is shown that the approximation of the equilibrium shape of the nucleus employed is valid for $x = 0$ and $x \approx 1$. (auth)

7299 RELATIVE INTENSITIES OF NUCLEAR QUADRUPOLE RESONANCE LINES OF Sb^{121} IN ANTIMONY TRICHLORIDE. V. S. Grechiskin and I. A. Kuntsel (Perm State Univ., USSR). Zh. Eksperim. i Teor. Fiz., 43: 1712-13(Nov. 1962). (In Russian)

The relative line intensities of antimony isotopes are studied in crystal antimony trichloride. The transition probabilities are calculated. A forbidden transition is detected in an indirect manner. The theoretical calculations are compared with the experimental data. (auth)

7300 KINETIC ENERGY OF FRAGMENTS EMITTED IN SUBBARRIER FISSION. V. N. Okolovich and G. N. Smirenkin. Zh. Eksperim. i Teor. Fiz., 43: 1861-4(Nov. 1962). (In Russian)

An analysis is made of the data of experiments in which the distributions of kinetic energies of fragments from spontaneous and induced fission of U^{238} and Pu^{240} compound nuclei are compared. It is shown that these data, along with other measurements, indicate the existence of an effect exceeding the experimental errors and which consists in a decrease of the mean kinetic energy E_k upon a change from superbarrier to subbarrier fission. This conclusion is confirmed by data on the number of secondary neutrons emitted per fission event. A semi-quantitative interpretation of the observed effect and its dependence on the nuclear charge are presented on basis of energy balance considerations. The results of the work indicate the necessity of refining Terrell's classification of E_k by separately considering the data on spontaneous and induced fission of nuclei. (auth)

7301 MOMENTS OF INERTIA OF A HEATED NUCLEUS AND ANGULAR ANISOTROPY OF THE FISSION FRAGMENTS. Yu. T. Grin. Zh. Eksperim. i Teor. Fiz., 43: 1880-4(Nov. 1962). (In Russian)

The moments of inertia of a nucleus at a temperature $T \neq 0$ are calculated as a function of the excitation energy of the nucleus. Good agreement between the theory and experiment is found for the angular anisotropy of the fission fragments. (auth)

7302 ON A METHOD FOR INVESTIGATING OPTICAL ANISOTROPY AND SHAPE OF THE SURFACE OF ATOMIC NUCLEI. L. E. Lazareva and B. A. Tulupov (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1910-13(Nov. 1962). (In Russian)

A method for investigating optical anisotropy and the shape of the surface of atomic nuclei is discussed based on a study of the angular distributions of charged subbarrier particles emitted by deformed nuclei in photonuclear reactions. (auth)

7303 THEORY OF A FERMI FLUID CONSISTING OF TWO TYPES OF PARTICLES. APPLICATION TO THE NUCLEUS. A. B. Migdal. Zh. Eksperim. i Teor. Fiz., 43: 1940-52(Nov. 1962). (In Russian)

The rigidities of a system with respect to changes in density and concentration are expressed in terms of the scattering amplitude for identical and different particles; in this way the amplitudes in the nucleus can be found from the observed rigidity values. Expressions are derived which relate the vertex part and polarization operator to the scattering amplitude at the Fermi surface. It is shown that the momenta at the Fermi boundary for each type of particle are related to the particle densities in accordance with the formula for the density of an ideal Fermi gas. The effective mass of quasiparticles in the nucleus is estimated. (auth)

7304 ELECTRON PAIR CREATION BY PHOTONS. Theodoor Holtwijk. Thesis, Groningen, Netherlands, Rijksuniversiteit, 1960. 132p.

Measurements of the electron-pair and recoil-nucleus distributions from the $\gamma \rightarrow 2e$ process at low photon energies are carried out, using an expansion cloud chamber. The experimental results are compared with predictions of the Born and other theories. (T.F.H.)

7305 GIANT RESONANCE DIPOLE TRANSITIONS IN NUCLEI. Richard A. Ferrell (Univ. of Maryland, College Park). Technical Report No. 268. Prepublication Copy. 8p.

An experimental and theoretical outline is given of the scattering of gamma radiation by nuclei, and in particular of the giant dipole resonance reactions. (T.F.H.)

7306 CALCULATION OF ACTIVATION BY EPITHERMAL AND FAST NEUTRONS. J. T. Lence (Astra, Inc., Raleigh, N. C.). Preprint No. ASTRA 813-2.1. Prepublication Copy. 31p.

Methods for calculating yields of reactions involving fast and epicadmium neutron spectra are presented, based on neutron fission spectra and spectra in shielding materials. Results are presented for activation of Al^{27} (by the (n,α) reaction), Ti^{46}, Fe^{56}, Ni^{58}, S^{32}, and Ti^{48} (by the (n,p) reaction). Methods for increasing the intensity of the fast flux with respect to the thermal flux are described. (T.F.H.)

Particle Accelerators

Refer also to abstract 6808.

7307 (BNL-5792) ENERGY MODULATION OF A 3.6 MILLION VOLT VAN DE GRAAFF ELECTROSTATIC ACCELERATOR. E. J. Rogers (Brookhaven National Lab., Upton, N. Y.). [July 23, 1962]. Contract [AT(30-2)-Gen-16]. 13p.

Energy of a 3.6 Mev electrostatic accelerator is modulated upward to match the rising magnetic field in the Cosmotron, thus providing a longer injection period and consequently higher accelerated beam intensity. The modulating voltage, generated by a resonant charging system, is capacitively induced in the high voltage terminal by an insulated liner in the Van de Graaff tank. (auth)

7308 (BNL-6511) MINUTES OF THE CONFERENCE ON LINEAR ACCELERATORS FOR HIGH ENERGIES HELD AT BROOKHAVEN NATIONAL LABORATORY, AUGUST 20-24, 1962. A. van Steenbergen, H. B. Knowles, S. Ohnuma, and C. K. Sinclair, comps. (Brookhaven National Lab., Upton, N. Y.). Contract [AT(30-2)-Gen-16]. 392p.

A total of 35 papers is included. Separate abstracts were prepared for each paper. (J.R.D.)

7309 (BNL-6511(p.1-6)) THE NEW BEVATRON INJECTOR. L. Smith (California. Univ., Berkeley. Lawrence Radiation Lab.).

Efforts to improve the performance of the Bevatron accelerator are described. Included are discussions concerning provisions for an external beam, more shielding, and preparations for a 20-Mev linac to serve as a proton injector. This linear accelerator employs grid focusing in the drift tubes with consequent low beam intensity output. Information is also included on the preinjector ion source, drift tubes, vacuum system, r-f system, pickup probes, and excitation power levels. (J.R.D.)

7310 (BNL-6511(p.7-18)) THE ZGS INJECTOR. R. Perry (Argonne National Lab., Ill.).

It is noted that the linear accelerator injector for the ZGS is a copy of the Brookhaven AGS injector. A discussion is presented of design areas associated with the ZGS injector in which significant differences from the AGS in-

jector are mentioned. A sketch of the waveguide and linac arrangement is included along with a block diagram of the system for measuring the linac field distribution and a block diagram of the r-f system. Also included are results of efforts devoted to tank flattening by a bead pulling technique. (J.R.D.)

7311 (BNL-6511(p.19-37)) THE P.L.A. OF THE RUTHERFORD LABORATORY. K. Batchelor (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England).

Design of this accelerator is described. It consists of three separate cavities similar in arrangement to the 50-Mev linac injector for the CERN synchrotron. The nominal output energies of the tanks are 10, 30, and 50 Mev, respectively. The linac is preceded by a 500-kev preinjector. A discussion of accelerator operation is included in which faults causing lost operating time in 1961 are examined. (J.R.D.)

7312 (BNL-6511(p.38-49)) THE NIMROD INJECTOR. N. D. West (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England).

A description of the Nimrod accelerator is presented. Included are descriptions of the preinjector, the linear accelerator, and initial operation. (J.R.D.)

7313 (BNL-6511(p.50-64)) DESIGN OF DRIFT TUBE LINACS. G. W. Wheeler (Yale Univ., New Haven).

Efforts devoted to a feasibility study leading to the design of a proton linac of the meson factory type are discussed. Such a linac calls for energies of 500 Mev to 1 Bev. Recent efforts were devoted to design of the low-energy portion of the machine, resulting in production of a preliminary design of a drift-tube linac for energies up to 225 Mev. Information and data associated with this design are presented. (J.R.D.)

7314 (BNL-6511(p.65-75)) PHASE OSCILLATION AND TRANSVERSE FOCUSING. S. Ohnuma (Yale Univ., New Haven).

Results of a preliminary study concerning linear accelerator phase oscillations and the transverse motion of protons in these accelerators are presented and discussed. The coupling effects of longitudinal and radial motions are considered. Numerical calculations were made for one of seven tanks, and it is noted that the program applies to other tanks up to 200 Mev. In phase oscillation studies, 14 representative points were chosen as the starting values of phase and energy. A diagram of these points is included along with a graph representing phase oscillations vs. drift-tube number, and data related to the determination of suitable magnet strength. (J.R.D.)

7315 (BNL-6511(p.76-97)) DESIGN OF DRIFT TUBE LINACS. D. Young (Midwestern Universities Research Assn.).

The proposed 200-Mev linear accelerator injector for the 10-Bev FFAG accelerator is discussed. Other discussion is also included concerning linac work at MURA which is separate from the FFAG injector design. Parameters for the 750-kev Cockcroft-Walton preinjector and for the buncher are given along with parameters for the linac and debuncher. Also included are results of drift-tube calculations for 50, 100, 150, and 200 Mev. (J.R.D.)

7316 (BNL-6511(p.98-100)) THE YALE DESIGN STUDY OF LINEAR ACCELERATORS. V. W. Hughes (Yale Univ., New Haven).

A brief discussion is presented concerning interest at Yale in high-beam-intensity proton linear accelerators in the energy range 600 to 1000 Mev for use in research. (J.R.D.)

7317 (BNL-6511(p.101-9)) SECONDARY BEAMS FROM A HIGH ENERGY LINAC. W. A. Blanpied (Yale Univ., New Haven).

Results of a study concerning secondary beam formation and targeting for high-intensity proton accelerators with energies between 500 Mev and 1 Bev are presented. The linear accelerator considered is to be used mainly for production of pion, muon, and neutrino beams. The implication is that this accelerator should not be regarded as complete until a secondary beam handling system and experimental area are available. A summary of beam intensity-experimental area parameters is tabulated. (J.R.D.)

7318 (BNL-6511(p.110-23)) SHIELDING AND EXPERIMENTAL LAYOUT. H. B. Knowles (Yale Univ., New Haven).

It is noted that the beam current from high-intensity linear accelerators with energies of 500 Mev to 1 Bev will be about 1000 times as great as that of any previous accelerator. This introduces special shielding problems. In a study of these problems it was concluded that the permissible fluxes must be reduced in such a way that at a neutron energy of 1 Bev it will take a flux of only about 1 neutron/cm^2 to produce 100 mrem/40 hrs (tolerance for project work). Considerations related to experimental area shielding are discussed including the neutron cascade process, gamma radiation, and meson fluxes. (J.R.D.)

7319 (BNL-6511(p.124-7)) FEASIBILITY STUDY OF A π MESON LINEAR ACCELERATOR. R. L. Gluckstern (Yale Univ., New Haven).

Results of a study concerning the feasibility of a linear accelerator for secondary beams of π mesons are presented. This machine is to be used in conjunction with a proton linear accelerator in the range of 600 to 800 Mev. A method of estimating beam intensity and optical qualities is included. (J.R.D.)

7320 (BNL-6511(p.128-61)) DESIGN OF LONG IRIS-LOADED LINACS. R. B. Neal (Stanford Univ., Calif. Stanford Linear Accelerator Center).

A review of the present status of the Stanford two-mile electron accelerator is presented. The main parameters of this machine are tabulated, along with specifications for stage I and stage II. In other discussions, results of recent measurements on characteristics of accelerator structures are presented. Data pertinent to the design of proton accelerators are included. (J.R.D.)

7321 (BNL-6511(p.162-70)) PHASE AND RADIAL MOTION IN LINACS. R. B. R-Shersby-Harvie (European Council for Nuclear Research, Geneva).

Orbit calculations for linear accelerators operating at 200 Mev to 2 Bev were made. These calculations were carried out to investigate the validity of the linear theory and to study the effects of errors in machine manufacture. Machines operating at 1000 and 400 Mc/s were considered. It was found that for the 1000 Mc/s machines, energy measurement of 0.1% does not contain orbits to within a $\pm 10°$ phase angle spread, while for the 400 Mc/s machine, measurement to 0.2% seems to contain most orbits to within $\pm 10°$ phase angle spread. This makes a strong case for finding more precise methods of setting up the tank fields. (J.R.D.)

7322 (BNL-6511(p.171-3)) SOME THOUGHTS ON LOW-VELOCITY TRAVELING WAVES. E. D. Courant (Brookhaven National Lab., Upton, N. Y.).

In an examination of higher-order Floquet modes in a

periodic waveguide, no configurations were found that would be more efficient than the standard iris-loaded guide. It was found necessary to make the drift tubes long and narrow to obtain fair efficiencies. Aspects of the use of very thin irises are discussed. (J.R.D.)

7323 (BNL-6511(p.174-83)) DESIGN OF LONG IRIS-LOADED LINACS. K. Batchelor (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England).

Results of research are reported on Alvarez accelerator structures for energies of the order of 200 Mev and traveling wave structures for use above 200 Mev, where the Alvarez structures become inefficient as measured by the effective shunt impedance per unit length. (J.R.D.)

7324 (BNL-6511(p.184-95)) SUPERCONDUCTING LINACS. K. Batchelor (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England).

Considerations in the design of a superconducting proton linear accelerator (PLANET) are discussed. This machine would accelerate a proton beam of the order of 1 ma in c-w operation. The r-f power lost to the accelerating structure would be reduced by a factor of approximately 10^4 in this accelerator as compared with conventional linacs. Research is required on this linac in the areas of phasing, beam loading, beam dynamics, r-f control, mechanical problems with low temperatures, and properties of superconducting materials. (J.R.D.)

7325 (BNL-6511(p.196-203)) SUPERCONDUCTING LINACS. R. B. Neal (Stanford Univ., Calif. Stanford Linear Accelerator Center).

A short review is presented of the latest results of investigations with superconducting cavities using higher r-f power levels than those reported at the CERN Conference in July 1962. Test cavities 14 in. long and 14 in. in diam. were used. Results were obtained with Sn- and Pb-plated Cu cavity walls at temperatures of 1.75 to 4.2°K. (J.R.D.)

7326 (BNL-6511(p.204-5)) SOME REMARKS ON SUPERCONDUCTING LINACS. L. C. Teng (Argonne National Lab., Ill.).

Aspects of superconductor properties are examined in comparison with metals with low resistivity at cryogenic temperatures which are not necessarily superconducting. Other discussion is included concerning the inhibition of superconductivity by high magnetic fields. (J.R.D.)

7327 (BNL-6511(p.206-8)) SOME THOUGHTS RELATED TO CRYOGENIC LINACS. R. Perry (Argonne National Lab., Ill.).

The suitability of a linac for production of intense neutron fluxes of the order of 10^{18}/sec was examined. Thought was given to the design of a machine to produce a proton beam of 20 ma d-c at 500 to 600 Mev. Research on such a machine is required to develop access to the r-f cavity and superconducting r-f contacts, a method of maintaining mechanical alignment, and a technique for tank flattening. (J.R.D.)

7328 (BNL-6511(p.209-23)) THE STEPPED PHASE VELOCITY LINEAR ACCELERATOR. H. B. Knowles (Yale Univ., New Haven).

An analysis of the stepped-phase-velocity linac is presented. It is noted that some electron accelerators are operated at a constant phase velocity in the bunching section and resemble a stepped-phase-velocity accelerator in this area. The analysis was done for this reason and because of the current interest in construction of meson accelerators. The most general case is considered in the analysis. A discussion of the approximations used is included. It is noted that small terms can be conveniently dropped if the accelerated particles are protons, but should be retained if lighter particles are to be accelerated. (J.R.D.)

7329 (BNL-6511(p.224-34)) STEPPED PHASE VELOCITY LINACS. L. Smith (California. Univ., Berkeley. Lawrence Radiation Lab.).

Activities in a program to analyze high-energy stepped-phase-velocity linacs are reported. The analysis was conducted using a computer. The numbers available from the analysis apply to one specific case. The case is for an energy of 200 Mev, a field gradient of 8 Mv/m, and a section length of 12 wavelengths. (J.R.D.)

7330 (BNL-6511(p.235-60)) BEAM OBSERVATIONS IN THE P.L.A. K. Batchelor (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England).

A discussion is presented concerning measurements associated with proton beams using a precise time-of-flight technique. The experimental proton beam passes through a series of quadrupole doublets and two scattering chambers. Flip-in scintillators, viewed by television, are used to monitor the beam. Each scattering chamber contains an Al foil; the distances between the foils are used to define the flight path. The scintillation counters detect only elastically scattered protons and are maintained at an identical distance from the foil in both scattering locations, so that only the flight time between the two foils is measured. A diagram of the experimental arrangement is included along with graphically presented results. (J.R.D.)

7331 (BNL-6511(p.261-6)) BUNCHERS. J. P. Blewett (Brookhaven National Lab., Upton, N. Y.).

It is noted that without prebunching, a linear accelerator operating at a stable phase angle 30° from the peak of the r-f wave can accept about 20% of the beam from its preinjector. An investigation which is in progress aimed at developing sophisticated bunching techniques to increase this acceptance value to as close 100% as possible is described. (J.R.D.)

7332 (BNL-6511(p.267-73)) DEBUNCHERS. K. Johnsen (European Council for Nuclear Research, Geneva).

A debuncher was installed at the 50-Mev linac end of the CERN PS which effected a smoothing out of r-f instability results in the linac tanks and reduced momentum errors. In light of this, it was decided to incorporate a debuncher in the study for a high-energy linac because it is useful in reducing the effects of machine irregularities. A description of the proposed method is given by reference to included diagrams. (J.R.D.)

7333 (BNL-6511(p.274-82)) LINAC FOCUSING. L. Smith (California. Univ., Berkeley. Lawrence Radiation Lab.).

The arrangement and parameters for focusing quadrupole magnets between linac sections were considered. In this case the transfer matrix applies to a particle exposed to a constant r-f defocusing force, which implies going through with a constant phase. A few cases with doublets in the drift section were considered and results of computations concerning part of these cases are diagrammed. (J.R.D.)

7334 (BNL-6511(p.283-8)) BEAM LOADING. F. E. Mills (Midwestern Universities Research Assn., Madison, Wis.).

Activities in developmental programs on beam loading at MURA are described. A general approach to beam loading involves several stages of calculation. The fields excited in the cavity by the power supply give rise to current and

charge distributions of the beam in the cavity. The beam can be described as being an arbitrary distribution of charge along a line and this charge can then be made to move with velocity v through the cavity. The solution is represented as a sum of cavity modes and free space solutions for the beam. Results are included which show the cavity voltage that is induced as a function of the velocity of current for the fundamental harmonic of the charge distribution. Further work is planned on wall losses and higher cavity modes. (J.R.D.)

7335 (BNL-6511(p.289-93)) A STUDY OF POSSIBLE DEUTERON ACCELERATION. E. D. Courant (Brookhaven National Lab., Upton, N. Y.).

A discussion concerning acceleration of deuterons in present proton linear accelerators is presented. It is noted that acceleration should be feasible in the mode where the particle spends two periods of the r-f in each unit cell of the linac, rather than one in the case of protons, provided the products of transit time factors are not less than half what they are in the proton mode. (J.R.D.)

7336 (BNL-6511(p.294-302)) AN ACHROMATIC BEAM TRANSPORT SYSTEM. D. A. Swenson (Midwestern Universities Research Assn., Madison, Wis.).

Injection into the proposed 10-Bev FFAG accelerator requires transport of the 200-Mev linac beam to the inside of the FFAG ring. The linear accelerator is to be located 12 ft above the median plane of the main machine. The achromatic system needed to transport the linac output beam to the FFAG machine injection location is discussed. (J.R.D.)

7337 (BNL-6511(p.303-5)) RF POWER DEVELOPMENTS. G. W. Wheeler (Yale Univ., New Haven).

Engineering aspects of supplying r-f power to long linacs are examined. Included are discussions concerning frequency ranges of interest and design of power systems. Difficulties in the use of klystrons are also discussed. (J.R.D.)

7338 (BNL-6511(p.306-17)) RF POWER SOURCES. M. V. Hoover (Radio Corp. of America, Camden, N. J.).

A discussion of the basic differences between single end and double end structures for many of the gridded high-power tubes is given. Other discussion is included on strip beam triodes, shielded triode concepts, and types of cathode bars used in high-power tubes. High-power tubes in existence or under development at RCA are listed and described. (J.R.D.)

7339 (BNL-6511(p.318-22)) THE ZGS INJECTOR VACUUM SYSTEM. R. Perry (Argonne National Lab., Ill.).

The injector for the ZGS machine is a 50-Mev linear accelerator, with a volume in the linac cavity of the order of 25,000 liters. A description of the vacuum system for this linac is described. Data on cost are also included. (J.R.D.)

7340 (BNL-6511(p.323-34)) ION SOURCE DEVELOPMENTS. R. Perry (Argonne National Lab., Ill.).

A discussion of developmental work on ion sources such as the duoplasmatron and the r-f source is presented. (J.R.D.)

7341 (BNL-6511(p.335-7)) POLARIZED PROTON SOURCE DEVELOPMENT. R. P. Featherstone (Minnesota. Univ., Minneapolis).

Development of a polarized proton source for a 68-Mev proton linac is described. The linac is a 3-tank system in which grid focusing is used throughout. (J.R.D.)

7342 (BNL-6511(p.338-80)) AGS PREINJECTOR BEAM EMITTANCE AREA AND EMITTANCE AREA DENSITY DISTRIBUTION MEASUREMENTS. A. van Steenbergen (Brookhaven National Lab., Upton, N. Y.).

Efforts to raise the linac proton current intensity by increasing the preinjector output current showed that the linac output current did not increase linearly with the preinjector current. Since ion source parameters and extraction region geometries may have a pronounced effect on beam emittance, a systematic study was undertaken to measure beam emittance area, phase space density distribution, and maximum obtainable beam intensity at 750 kev as a function of various duoplasmatron parameters and extraction geometries. Resulting data are included along with an analysis of results. (J.R.D.)

7343 (BNL-6511(p.381-5)) DRIFT TUBE ALIGNMENT EXPERIENCE ON THE AGS LINAC INJECTOR. I. J. Polk (Brookhaven National Lab., Upton, N. Y.).

The first alignment of the drift tubes was done on a tank-by-tank basis as each 10-ft section was positioned on the supporting pile system. The tubes were located to within ±0.003 in. Later measurements indicated random shifting of the drift tubes had occurred so that the alignment is worse than it was initially. It is noted that accuracy specifications may be too strict. (J.R.D.)

7344 (CERN-62-25) NANOSECOND HIGH VOLTAGE PULSES FOR INTERNAL CYCLOTRON BEAM DEFLECTION. H. Beger, M. Giesch, and W. Stockdreher (European Organization for Nuclear Research, Geneva). Aug. 28, 1962. 35p.

The projected electrical beam deflection system for the generation of a 40 nsec proton beam pulse in the CERN 600-Mev synchrocyclotron is described. A test model of the most critical part of this system, the triggered spark gap, was constructed and tested carefully. The necessary operation conditions of this gap (electrode distance, gas flow, and gas pressure) are described to obtain a deflection pulse of 45 kv, 10 nsec rise time and ±5 nsec jitter. (auth)

7345 (TID-15535) A COMPUTER PROGRAM TO INVESTIGATE ORBIT STABILITY IN CIRCULAR ACCELERATORS. G. Parzen, J. C. Anderson, M. R. Storm, J. M. Maynard, and H. L. Carlson (Midwestern Universities Research Assn., Madison, Wis.). [Apr. 1962]. Contract [AT(11-1)-284]. 13p.

A program is described for investigating orbit stability in circular accelerators. Various inputs for the median plane magnetic field are provided to accept either experimentally measured data or to investigate the effects of possible perturbations. The median plane magnetic field can contain radial and azimuthal components as well as the vertical component. The motion of the particle can be Fourier analyzed and plotted. The median plane field is computed on a mesh and the field during the run is found by interpolation on the mesh. The magnetic field off the median plane is found by expanding in powers of z, with up to cubic terms in z possible in the magnetic potential. (auth)

7346 (TID-17429) ANALOG COMPUTER FOR QUADRUPOLE MAGNET DESIGN. John W. Hammann (Argonne National Lab., Ill.). Sept. 1962. Contract [W-31-109-eng-38]. 28p. (UAC-6873)

In the design of particle accelerators, magnets are sometimes used to bend the paths of charged particles in linear accelerators for focusing and defocusing purposes. These magnets, in the present case, are known as quadrupoles. Their design hinges on the solution of certain mathematical expressions of particle trajectories. A computer of the analog type was constructed to solve the equations and so facilitate magnet design. The analog computer for this application has dials labeled "L," "μ," and "θ." The set-

tings of these dials represent the design parameters under study. The operator can set the dials of each stage to any of thousands of different combinations of L, μ, and θ. The results of his settings may be observed on a CRO screen. He can then proceed to search for the best combination of control settings with regard to their effect on particle trajectories. Once having found a satisfactory combination, the corresponding magnet design parameters are obtained from the settings of the controls. Three features of construction requiring special consideration were: the high gain, minimum phase shift, and minimum crosstalk. These items and others are discussed from the practical as well as the theoretical point of view. (auth)

7347 (UCRL-10065) MECHANICAL FEATURES OF THE rf SYSTEM FOR THE BERKELEY 88-INCH CYCLOTRON. Kenneth F. Mirk (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 4, 1962. Contract W-7405-eng-48. 21p.

Four features are described: the movable-panel drive system, ceramic ball bearings, rf hinges, and dee construction. The rf tuning is accomplished by varying the volume between the dee stem and six movable panels. Power to move the panels is supplied by four hydraulic cylinders. The hydraulic drive mechanism and control system are described. A special ceramic ball bearing, with alumina balls and stainless steel races, was developed. It operates in the presence of high vacuum, rf field, and radiation without organic lubrication. Bearing construction and test results are described. The rf current-carrying hinges between the movable panels were designed to optimize the hinge thickness and length so that bending stresses and temperature rise were minimized. Graphs showing the relations between hinge thickness, length bending stress, and temperature rise are presented, together with hinge configuration. The dee-stem and dee structure is approximately 14 ft long and weighs 2800 lb. Support for the entire assembly is provided by cantilevering it from the rear of the resonator tank. Materials and fabrication procedure for the dee panel structure are described. (auth)

7348 (UCRL-10068) THE ION-SOURCE MECHANISM FOR THE BERKELEY 88-INCH CYCLOTRON. James M. Haughian and Richard J. Burleigh (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 29, 1962. Contract W-7405-eng-48. 11p.

The ion-source tube is inserted vertically through the magnet yoke and upper pole. This position was chosen because it saves peripheral space within the cyclotron, and permits withdrawal of the ion source through the roof shielding for servicing. The source is remotely controlled and can be moved either radially or azimuthally, and can also be rotated about its own axis. The system of mechanism for providing these movements is described, as well as related equipment. (auth)

7349 (UCRL-10070) MEASUREMENT OF BEAM PHASE OF THE BERKELEY 88-INCH CYCLOTRON. Charles G. Dols (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 9, 1962. Contract W-7405-eng-48. 21p.

A sampling oscilloscope has been used to display beam pulses of the Berkeley 88-in. cyclotron. The beam impinges on a water-cooled Cu target that is partially enclosed in a water-cooled rf shield. A hydraulic cylinder drives the probe radially. Satisfactory signals relative to the noise were achieved with an average beam current of 1 μA. The phase of the beam with respect to the dee rf can be resolved to better than 5°. Plans for further development of the probe are discussed. (auth)

7350 (UCRL-10085) A HALL PROBE ASSEMBLY FOR THE BERKELEY 88-INCH CYCLOTRON MAGNET. Robert de Forest (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 13, 1962. Contract W-7405-eng-48. 16p.

A Hall probe was used in measurements requiring the resolution of a few tenths of a gauss in a field of approximately 17 kgauss. The Hall probes exhibited a slow change of calibration with time. The calibration of one probe changed by nine parts in ten thousand over a period of 54 days. In the case of one generator, a step change in calibration was observed. The overall system is briefly discussed. The changes in calibration are described, together with possible explanations for this behavior. (auth)

7351 PARTICLE ACCELERATORS. W. Hanle (Universität, Giessen, Ger.). Kerntechnik, 4: 569-73(Dec. 1962). (In German)

Previous articles have covered several of the large Western European accelerators. The present article contains a list of the larger particle accelerators in Western Europe as well as some informative details concerning a few accelerator types not yet reported on, for instance the French proton synchroton "Saturne," the electron synchrotron at Frascati, the synchrotron at Göttingen, and the linear accelerator at Darmstadt. (auth)

7352 SECTOR-FOCUSED CYCLOTRONS. Proceedings of the International Conference on Sector-Focused Cyclotrons, University of California, Los Angeles, 17-20 April 1962. Kai Siegbahn and F. T. Howard, eds. Nucl. Instr. Methods, 18, 19: 1-647(Nov. 1962).

The purpose of the conference was to allow an exchange of information on the operating characteristics of several recently completed machines, to facilitate the exchange of information by groups which were interested in "meson factories," and to aid groups which were considering the acquisition of cyclotrons to evaluate the scope and cost of such a program. Separate abstracts were prepared for the papers. (W.D.M.)

7353 DESIGN AND OPERATION OF THE U.C.L.A. 50 Mev SPIRAL-RIDGE CYCLOTRON. David J. Clark, J. Reginald Richardson, and Byron T. Wright (Univ. of California, Los Angeles). Nucl. Instr. Methods, 18, 19: 1-24 (Nov. 1962). (In English)

The design and operation of the U.C.L.A. 50 Mev cyclotron is described. The magnetic field is presented in a series of graphs and orbit calculations on beam stability are given. The results of experimental observations and measurements on the internal beam include beam intensity graphs and photographs, plots of ν_z and ν_r from r.f. knockout measurements, beam intensity as a function of dee voltage, and radial oscillation amplitude of the beam. Because of lack of shielding, the beam has been restricted to 2 μA of 50 Mev protons by use of a 5% duty cycle. An increased intensity is expected when a puller electrode is used at the source. The tuning up of the beam by means of the eight circular coils for trimming the magnetic field has been found to be quite simple in practice. Efforts to get an external beam are now proceeding in the permanent shielding vault. (auth)

7354 OPERATION OF A 40-INCH RADIAL RIDGE CYCLOTRON. A. J. Cox, D. E. Kidd, W. B. Powell, B. L. Reece, and P. J. Waterton (Univ. of Birmingham, Eng.). Nucl. Instr. Methods, 18, 19: 25-32(Nov. 1962). (In English)

Recent measurements on a three sector isochronous cyclotron of tight design giving 12 Mev deuterons are described. A concentrated 600 μA beam has been accelerated into the region of sharp magnetic field fall-off and phase

measurements show that the pulses of beam, which are about 30° wide, have a negligible phase shift in 400 turns. Measurements with field shapes which are not isochronous show that considerable field variations can be tolerated. As a special feature the machine has provision for axial injection of ions from an external source. By this method 20 μA of deuterons have been obtained at full radius with a transmission efficiency of 3%. (auth)

7355 GENERAL DESCRIPTION AND OPERATING CHARACTERISTICS OF THE BERKELEY 88-INCH CYCLOTRON. E. L. Kelly (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 33-40(Nov. 1962). (UCRL-10081). (In English)

The Berkeley 88-inch cyclotron is a variable-energy spiral-ridge machine with an electrostatic deflector for beam extraction. This accelerator was designed to satisfy the needs of the nuclear chemistry and low-energy physics groups, for variable-energy beams of a variety of ions. It will accelerate protons up to 50 Mev, deuterons up to 65 Mev, and heavier ions up to corresponding energies. The machine is expected to produce an external beam of 100 to 200 μA. The r.f. has a frequency range of 5.5 to 16.5 Mc/s and a working voltage of 70 kV, dee to ground. The single-dee construction permits operation on the third harmonic mode, which in effect gives another factor of 3 in frequency range. The magnet has three flat hills on each pole, which produce a maximum magnetic-field spiral angle of approximately 55 deg. The iron gap between hills is 7.5 in., between valleys, 11.8 in. The maximum average field is 17 kG, with an effective flutter of ±3 kG. Pole-face windings are provided for trimming the magnetic field. The first internal beam was obtained in December 1961. Subsequent internal-beam studies with alphas at 12 kG (65 Mev) show a well-behaved beam out to full radius. The beam has not yet been extracted with the electrostatic deflector. (auth)

7356 NOTE ON A SPILL BEAM FROM THE 88-INCH CYCLOTRON. J. Reginald Richardson (Univ. of California, Los Angeles), Hans Willax, and W. B. Jones. Nucl. Instr. Methods, 18, 19: 41-5(Nov. 1962). (In English)

It was found that the application of a first harmonic of about 20 gauss to the magnetic field produced a high energy spill beam from the 88-inch cyclotron. Essentially all of the internal beam was removed radially in an azimuthal angular travel of 120°. No evidence was found for any axial loss of beam during this process. (auth)

7357 UNIQUE FEATURES IN THE OAK RIDGE ISOCHRONOUS CYCLOTRON. R. J. Jones, E. D. Hudson, R. S. Livingston, R. S. Lord, M. B. Marshall, W. R. Smith, W. H. White, Jr., and R. E. Worsham (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 46-61(Nov. 1962). (In English)

The results of the initial month of operation of the Oak Ridge Isochronous Cyclotron are presented along with a description of the machine. An 8-Mev proton beam was obtained at the full 32-in. radius on 18 March. Beam-phase studies since that time have lowered the threshold voltage from 13 to 8 kV. ORIC is designed as a variable energy, three-sector, 76-inch, fixed-frequency cyclotron to accelerate protons to 75 Mev and nitrogen 4^+ to 100 Mev. (auth)

7358 GENERAL DESIGN FEATURES OF THE UNIVERSITY OF COLORADO 52-INCH CYCLOTRON. D. A. Lind, J. J. Kraushaar, Rodman Smythe, and M. E. Rickey. Nucl. Instr. Methods, 18, 19: 62-5(Nov. 1962). (In English)

Design features of the University of Colorado cyclotron are briefly discussed. Operational experience with the various systems is included along with some information of the trial runs that succeeded in producing an internal beam. (auth)

7359 THE ACCELERATION AND EXTRACTION OF NEGATIVE HYDROGEN IONS IN THE C. U. CYCLOTRON. M. E. Rickey and Rodman Smythe (Univ. of Colorado, Boulder). Nucl. Instr. Methods, 18, 19: 66-9(Nov. 1962). (In English)

A negative hydrogen ion beam of several microamperes has been obtained in the University of Colorado cyclotron. A one microampere external proton beam has been extracted by stripping the electrons off with a 50 mg/cm^2 Al_2O_3 foil. (auth)

7360 ELECTRIC DISSOCIATION OF NEGATIVE HYDROGEN IONS IN CYCLOTRONS AND SYNCHROCYCLOTRONS. D. L. Judd (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 70-3(Nov. 1962). (In English)

Energies are estimated, above which negative hydrogen ions can not be accelerated in cyclotrons and synchrocyclotrons, because of their dissociation by the electric field $\gamma v \times B/c$. Their use in sector-focusing constant-frequency cyclotrons of several hundred Mev intended as "meson factories" would require magnetic fields lower than usual by at least a factor of two or three. However, this effect should not limit their use in the present generation of such machines of 20 to 80 Mev having $B_{max} < 20$ kG. The lower energy gain per turn in synchrocyclotrons leads to dissociation at somewhat lower energies. The limiting energy for any cyclotron can be approximated by the method described. The estimates are based on unpublished experimental results and approximate calculations of other workers. (auth)

7361 RELATIVISTIC CYCLOTRON FOR THE UNIVERSITY OF MILAN. A. Luccio, G. Pavanati, F. Resmini, C. Succi, and G. Tagliaferri (Univ. of Milan). Nucl. Instr. Methods, 18, 19: 74-80(Nov. 1962). (In English)

A fixed frequency, fixed energy Thomas cyclotron is presently under construction at the University of Milan. With a pole diameter of 166 cm, the planned energy is 45 Mev for protons; magnet winding and d.c. power supply are however rated to stand at least a 20% increase in energy. Model studies of the magnet field and r.f. resonator have been carried out to test the cyclotron design. Adjustment of the field to meet the isochronism requirement will be entrusted to contouring and shimming of the poletips, with only comparatively minor corrections left to coils. Acceleration of polarized protons is proposed, and work is in progress on a polarized proton source. The assembling of the cyclotron magnet in its final location is due to begin soon, and the tentative date for the completion of the machine is the end of 1963. (auth)

7362 SHIMMING OF A VARIABLE ENERGY, SECTOR-FOCUSED ISOCHRONOUS CYCLOTRON BY MEANS OF DIFFERENT PERMEABILITY METALS. A. Cabrespine and M. P. Bourgarel (Laboratoire Joliot-Curie de Physique Nucleaire, Orsay, France). Nucl. Instr. Methods, 18, 19: 81-7(Nov. 1962). (In English)

A new method permitting the realization of the magnetic field of variable energy, sector-focused, isochronous cyclotrons is proposed. Its object is to reduce to a minimum the electric correcting fields by using the variation of permeability of various magnetic materials in function of magnetic induction. Under such conditions fine adjustments will be made with valley coils. A method of "approximate calculus" of shims is given as well as the general characteristics of two cyclotrons in construction at Orsay according to that technique. (auth)

7363 SOME DESIGN FEATURES OF THE PHILIPS AVF PROTOTYPE. N. F. Verster, H. L. Hagedoorn, J. Zwanenburg, A. J. J. Franken, and J. Geel (Philips'

Gloeilampenfabrieken, Eindhoven, Netherlands). Nucl. Instr. Methods, 18, 19: 88-92(Nov. 1962). (In English)

The Philips AVF prototype is a variable energy, "all particle" accelerator with a pole diameter of 130 cm, intended as a study project. Some design features of the magnet, the pole shims, the vacuum chamber and the high frequency system are mentioned such as the use of vacuum walls inside the main tank, separating the shims and the coils from the clean vacuum, the use of a feedthrough insulator in the dee line, and of an electrolytically made resonant line. (auth)

7364 THE UNIVERSITY OF MICHIGAN 83-INCH CYCLOTRON. PART I. GENERAL DESCRIPTION. W. C. Parkinson and R. S. Tickle (Univ. of Michigan, Ann Arbor). Nucl. Instr. Methods, 18, 19: 93-7(Nov. 1962). (In English)

The scientific motivation, design criteria, and general features of the 83-inch variable-energy sector-focused cyclotron under construction at the University of Michigan are described. The cyclotron is designed to produce beams of protons, deuterons, and alpha particles of maximum energies 35 Mev, 40 Mev, and 80 Mev respectively to be used in conjunction with external beam optics for high resolution spectroscopic studies of heavy nuclei. The azimuthal field variation is produced by three sets of spiral shims having a maximum spiral angle of 43°. The r.f. system, a two-dee half-wave system using dee-stem insulators, is designed to provide a continuously variable frequency from 6.5 to 15 Mc/sec. The external beam handling system consists of two 110°, $n = \frac{1}{2}$ focusing magnets of radii of curvature 200 cm and three 180°, $n = \frac{1}{2}$ reaction products analysis magnets with radii of curvature of 133 cm. (auth)

7365 THE UNIVERSITY OF MICHIGAN 83-INCH CYCLOTRON. PART II. THE MAGNETIC FIELD. R. S. Tickle (Univ. of Michigan, Ann Arbor). Nucl. Instr. Methods, 18, 19: 98-101(Nov. 1962). (In English)

A description is given of the magnetic field configuration, the method of measurement, and the results of the measurements on the 83-inch magnet. (auth)

7366 THE UNIVERSITY OF MICHIGAN 83-INCH CYCLOTRON. PART III. THE R.F. SYSTEM. P. Bruinsma and W. C. Parkinson (Univ. of Michigan, Ann Arbor). Nucl. Instr. Methods, 18, 19: 102-4(Nov. 1962). (In English)

The r.f. system is a two-dee half-wave system using dee-stem insulators. The frequency is continuously adjustable under full power from 6.5 to 15 Mc/sec by means of shorting diaphragms. Designed for 140 kv peak dee-to-dee voltage the total r.f. power required is 170 kw. The three basic components, the resonator, the oscillator, and the coupling loop are described. (auth)

7367 THE UNIVERSITY OF MICHIGAN 83-INCH CYCLOTRON. PART IV. THE EXTERNAL BEAM HANDLING SYSTEM. J. Bardwick, J. M. Lambert, and W. C. Parkinson (Univ. of Michigan, Ann Arbor). Nucl. Instr. Methods, 18, 19: 105-10(Nov. 1962). (In English)

The external beam handling system consists of two 110°, $n = \frac{1}{2}$ focusing magnets with radii of curvature 200 cm and three 180°, $n = \frac{1}{2}$ analyzer magnets with radii of curvature of 133 cm. The energy resolution provided by the ion-optics is $E/\Delta E = 8 \times 10^3$. The design is based on first order theory, but second order equations were programmed for a 709 computer to study aberrations and the position of the focal surfaces in the three-magnet analysis system. The general properties of the magnets are described. (auth)

7368 THE UNIVERSITY OF MANITOBA CYCLOTRON. K. G. Standing, J. J. Burgerjon, and F. Konopasek (University of Manitoba, Winnipeg). Nucl. Instr. Methods, 18, 19: 111-13(Nov. 1962). (In English)

A method of shaping the cyclotron magnetic field by varying the temperature of Invar blocks is described. It seems capable of giving the required field shape over a fairly wide energy range. Other features of the cyclotron are mentioned. (auth)

7369 STUDIES FOR A 70 INCH VERSATILE CYCLOTRON. J. D. Lawson (Rutherford High Energy Lab., Harwell, Berks, Eng.). Nucl. Instr. Methods, 18, 19: 114-19 (Nov. 1962). (In English)

Design studies are well advanced for a 70" cyclotron capable of accelerating protons of energy up to 50 Mev, and heavier ions to energies which depend on their charge to mass ratio. In basic concept the machine resembles the Oak Ridge ORIC and the Berkeley 88" machines. There are three ridges, providing a field which makes an angle of 48° to the circumference at the maximum orbit radius. The field shape under different working conditions will be controlled by a combination of correcting windings and voids. A tape controlled precision table of 24" × 30" traverse will be used with a pantograph to move the measuring head in field surveys. A 3:1 frequency range for the dee voltage will be provided by an amplifier feeding a line with a variable shorting mechanism. Extraction presents a difficult problem, not yet solved. A septum at positive potential, (with leading edge shielded by a cooled earth plate) is contemplated; on the inner side, plates will shape the field to provide a regenerator. Consideration is being given to the injection of heavy ions through a hole along the pole axis. (auth)

7370 A PRELIMINARY REPORT ON THE 22-INCH SPIRAL RIDGE CYCLOTRON AT THE UNIVERSITY OF CALIFORNIA, DAVIS. J. A. Jungerman, N. F. Peek, and C. G. Patten (Univ. of California, Davis). Nucl. Instr. Methods, 18, 19: 120-4(Nov. 1962). (In English)

General features of the University of California, Davis 22-inch spiral ridge cyclotron are discussed. The accelerator has a C-magnet with a vertical gap. It is designed for service with continuous variation in particle energy using a maximum average magnetic field of 20-kilogauss. Protons can be accelerated to 12 Mev by means of a two dee radiofrequency system. In phase mode operation is planned for acceleration of deuterons and alpha-particles. (auth)

7371 CATALOGUE OF ISOCHRONOUS CYCLOTRONS. F. T. Howard (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 125-8(Nov. 1962). (In English)

Considerable enthusiasm is indicated for fixed-frequency cyclotrons with azimuthally varying magnetic fields designed to provide for isochronous operation at relativistic energies. Of the 41 projects brought to the attention of the Conference, 11 isochronous cyclotrons are now in operation and 12 under construction. The tabulation of specifications indicates that many machines provide for a wide range in energies and a choice of accelerated particles, with high-intensity beams goal projected up to about 800 Mev. (auth)

7372 MAGNETIC FIELD DESIGN AND MEASUREMENT FOR THE COLORADO 52 INCH CYCLOTRON. David A. Lind, Martin E. Rickey, and B. M. Bardin (Univ. of Colorado, Boulder). Nucl. Instr. Methods, 18, 19: 129-34(Nov. 1962). (In English)

A brief description of the magnet and spiral shim design for the Colorado 52 inch cyclotron is given showing the correlation between the model and full scale designs. Measuring techniques employing Hall plates and digital record-

ing are described. The equilibrium orbit properties as a function of magnetic field from 5 to 14 kgauss are given. A linear programming procedure for determination of current settings is described. (auth)

7373 FULL-SCALE MAGNETIC MEASUREMENTS ON THE BERKELEY 88-INCH CYCLOTRON. J. H. Dorst (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 135-47(Nov. 1962). (UCRL-10074). (In English)

The measurements of midplane flux density as a function of position and current are described within the framework of a general plan for obtaining useful magnetic fields. Data were taken point-by-point in a radial direction on a grid of 1 in. by 3 deg. The separate effects of currents in the main coil and in the 17 circular trim coils were measured. The Theoretical Group calculated recommended currents and the predicted fields. The predicted fields for combinations of currents were verified by magnetic measurements at six probable operating levels. The harmonic content of the combined fields and the use of coils in the valleys for fine control of harmonics are described. The operation of the flux density measuring system and the positioning systems is described. The flux density measuring system attained a resolution of $\frac{1}{4}$ G with a temperature-regulated Hall probe. The radial positioning was better than ±0.005 in. using a tensioned metal tape. The azimuthal accuracy was better than 0.01 deg—by using precisely located pins on a fixed disk. Problems of current control and hysteresis are discussed. Problems of data handling, and the use of a computer to find and correct errors are discussed. Final results are evaluated by comparison of predicted and measured fields. (auth)

7374 SOME MODEL MAGNET MEASUREMENTS AND THEIR APPLICATION TO THE DESIGN OF A 70 INCH SPIRAL RIDGE CYCLOTRON. J. H. Coupland and K. J. Howard (National Inst. for Research in Nuclear Science, Harwell, Berks, Eng.). Nucl. Instr. Methods, 18, 19: 148-58(Nov. 1962). (In English)

The factors considered in establishing an economic magnet design for the proposed 70 in. spiral ridge cyclotron for A.E.R.E. Harwell are presented, together with an account of the supporting experimental programme on a $\frac{1}{7}$th scale model. The effect of the ridges is allowed for by considering a system with smooth poles and an equivalent mean gap, this gap being determined by experiments with a pole configuration which is likely to be similar to the one finally chosen. Although the cyclotron is planned for a maximum field of 17 kgauss the experiments were limited and aimed to achieve an optimum design at 16 kgauss. The model was sufficiently flexible in assembly to allow simple variations in iron circuit cross sections and coil dimensions, and graphs are given showing the effect of a number of parameters of general interest such as coil length, diameter, and pole projection. (auth)

7375 ACHIEVEMENT AND MEASUREMENT OF THE ORIC MAGNETIC FIELD. E. D. Hudson, R. S. Lord, M. B. Marshall, W. R. Smith, and E. G. Richardson, Jr. (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 159-69(Nov. 1962). (In English)

The magnetic field for ORIC is achieved by means of conventional main coils requiring 1 Mw at maximum energy and internal coils with a power capability of another megawatt. The internal coils include ten pairs of circular trimming coils for shaping the radial gradient, a pair of valley coils in each of three sectors for changing the flutter, and three pairs of harmonic coils in each sector for cancelling the first harmonic. All internal coils are sealed in stainless steel containers. The objective of the measuring program was to obtain sufficient information on the effects of currents in all 21 magnet circuits so that current settings for these coils could be computed for any given particle and energy. A half million 5-digit field values were measured and recorded. Nine levels of main field excitation were measured both with and without each of the auxiliary coils. The difference between a composite azimuthally average field calculated from individual coil measurements and a measured field obtained with these same coil current values varied from one to eight gauss in about 14,500 gauss. (auth)

7376 MAGNET REGULATORS FOR ORIC. W. H. White, Jr. (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 170-6(Nov. 1962). (In English)

Twenty-one current regulator systems were built, tested, and put in operation in the Oak Ridge Isochronous Cyclotron. Two motor-generator units rated at 800 and 1200 kw are regulated by transistor banks in the field circuits of the generators. Nineteen other magnet supplies are rectifier-magnetic amplifier systems with ratings ranging from 6 to 30 kw at 250 to 1200 A; for regulation these incorporate transistor banks in series with the load. All units are current regulated to a few parts in 10^5; the transistor banks also reduce the ripple voltage of the rectifier units. By means of single controls all units can be varied from 2 to 100% of rated output current. Design features and selection of components for these systems are discussed. Design of the large banks of paralleled transistors used and experience in their operation are also reported. (auth)

7377 CHARACTERISTICS OF THE UCLA CYCLOTRON RADIOFREQUENCY SYSTEM. K. R. MacKenzie, S. Plunkett, and E. L. Petersen (Univ. of California, Los Angeles). Nucl. Instr. Methods, 18, 19: 177-83(Nov. 1962). (In English)

An account is given of the various interdependent factors that must be considered when dees are placed in the valleys of a sector focused cyclotron. The spiral shaped dees and r.f. resonator comprise a half wave structure in which an 11% frequency range is achieved by varying the cross-section of the inner conductor near the node. A grounded grid oscillator is coupled to the resonator by loops and transmission lines. The shape and weight distribution of the dees is such that they can be open on both sides, and yet can be easily supported at the outer radius. The distribution of heat allows the dees to be sawed from $\frac{1}{4}$ inch Cu plate with cooling supplied by conduction at the outer radius. They are installed by stretching the vacuum tank. (auth)

7378 RADIOFREQUENCY SYSTEM OF THE BERKELEY 88-INCH CYCLOTRON. B. H. Smith (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 184-93 (Nov. 1962). (UCRL-10021). (In English)

The design and performance of a single-dee self-excited radiofrequency system that tunes from 5.5 Mc/s to 16.5 Mc/s are discussed. Self-excited radiofrequency systems are compared with driven systems. The multipactoring phenomenon in variable-frequency systems is analyzed and discussed. (auth)

7379 COMPARISON BETWEEN VARIABLE-ENERGY SYNCHRO-CYCLOTRON AND SECTOR-FOCUSED CYCLOTRON. J. Sanada, I. Hayashi, and A. Suzuki (Tokyo Univ.). Nucl. Instr. Methods, 18, 19: 194-6(Nov. 1962). (In English)

A variable-energy synchrocyclotron is proposed. Then the comparison between this machine and the sector-focused cyclotron is made. (auth)

7380 A HIGH-VOLTAGE REGULATOR FOR THE ORNL 86-INCH CYCLOTRON. N. F. Ziegler (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 197-200(Nov. 1962). (In English)

A plate-voltage regulator was installed in the 86-inch Cyclotron to reduce the ripple in the r.f. output of the oscillator. Three 6921 high-perveance triodes in the series regulator reduce the plate-voltage ripple from 15% to 0.05% (peak-to-peak). The 2% (peak-to-peak) ripple (120 cps) remaining on the r.f. output is presumably due to the 60 cps supply to the oscillator filament. Problems encountered in the conversion are described. (auth)

7381 ORBITS IN AN AVF CYCLOTRON. H. L. Hagedoorn and N. F. Verster (Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Nucl. Instr. Methods, 18, 19: 201-28(Nov. 1962). (In English)

A theory is given describing the motion of ions in an AVF cyclotron. A Hamiltonian is formulated for the radial and also for the vertical motion. By the application of canonical transformations the equations for the radial motion are solved up to third degree terms in the oscillation amplitude, for the vertical motion only in the linear approximation. The lowest order terms in the flutter amplitude are given. The influence of small field errors on the radial motion is studied. (auth)

7382 ANALYTICAL THEORY OF BETATRONIC STABILITY IN SECTOR-FOCUSED ACCELERATORS. F. Fer (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). Nucl. Instr. Methods, 18, 19: 229-42(Nov. 1962). (In English)

The conditions of stability and isochronism in a sector-focused cyclotron are expressed by some simple formulas. Instead of using the formulation in terms of fields, one distinguishes, on a field map, the pure geometry of equilibrium trajectories, supposed to be given, and the law of variation of energy which is to be fitted to the requirements of stability and isochronism. This method allows to characterize the law of energy variation by a simple scalar parameter k; the stability itself is characterized by some intervals of k, of which bounds depend only on the geometry of the trajectories. All the requirements are then fulfilled by choosing k in these intervals. An application is given to the case of a low-energy sector focused cyclotron, and some extensions are briefly examined. (auth)

7383 EFFECTS OF FIELD IMPERFECTIONS ON RADIAL STABILITY IN A THREE-SECTOR CYCLOTRON. M. M. Gordon and W. S. Hudec (Michigan State Univ., East Lansing). Nucl. Instr. Methods, 18, 19: 243-67(Nov. 1962). (In English)

In a medium-energy, three-sector cyclotron the radial oscillation frequency is close to unity; as a result, the stability of the radial motion is sensitive to relatively small field imperfections of particular types. In the absence of field imperfections, the radial stability limits are defined by the location of the three unstable fixed-point orbits associated with the 3/3 resonance. A theoretical analysis is given which specifies the movement of these fixed-point orbits and the consequent evolution of the radial phase space diagram as a function of the imperfection field strength. Formulae are given for the critical strengths of these perturbations at which complete loss of stability sets in. These results can be used to set tolerances on certain undesirable field harmonics for any given three-sector magnet geometry. Radial phase plots and fixed point orbits obtained from extensive computer calculations using various kinds of field imperfections are presented and analysed. In most cases the agreement between the theory and the computer data is relatively good. The results also demonstrate that the sensitivity of the radial stability to field imperfections increases rapidly with the amount of spiral in the main three-sector field. (auth)

7384 THREE COMPUTER PROGRAMS FOR CALCULATING CYCLOTRON ORBITS. H. C. Owens (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 295-302(Nov. 1962). (UCRL-10083). (In English)

Three computer programs for calculating particle orbits with linearized vertical motion in general cyclotron magnetic fields are described in detail. The first program is used for finding properties of equilibrium orbits and small oscillations about them. The second program is a very flexible routine for determining the history of a particle under various conditions, including acceleration. Flexibility is achieved through the use of options such as a resonance-hunt routine, harmonic-bump routines, and an equilibrium-orbit-search routine. The third program, the deflector program, allows various combinations of electrostatic, magnetic, and regenerative extractors to be used. (auth)

7385 ANALYZING METHODS FOR ORIC MAGNETIC FIELDS. R. H. Bassel, R. S. Bender, and J. G. Innes (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 303-8(Nov. 1962). (In English)

Computer programs used in the design of the magnetic fields for ORIC are discussed. The final magnet configuration is shown and special features are described. Deflection studies and deflection characteristics are summarized. (auth)

7386 CALCULATION OF CYCLOTRON TRIM-COIL CURRENTS FOR FIELD OPTIMIZATION BY LINEAR PROGRAMMING METHODS. A. A. Garren (Univ. of California, Berkeley). Nucl. Instr. Methods, 18. 19: 309-22 (Nov. 1962). (UCRL-9916). (In English)

Determination of the current settings in the circular pole-face windings of fixed-frequency cyclotrons for optimization of the magnetic field may be solved with the mathematical technique of linear programming. The resulting fields are optimal with regard to particle phase lag as well as radial and vertical stability, and the currents do not exceed preassigned limits. (auth)

7387 COMPUTER PROGRAMS FOR AN AVF CYCLOTRON. N. F. Verster and H. L. Hagedoorn (Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Nucl. Instr. Methods, 18, 19: 327-35(Nov. 1962). (In English)

A coherent group of magnetic field measurements and computer programs has been developed. With the measurements the field shape and the influence of the trimming coils are determined. The results are delivered as punched tape. With the computer programs the field shape measurements are reduced to tables of Fourier coefficients and the orbits studied in these fields. One of the results is the isochronous field. From the measurements of the trimming coil influence the optimum currents to approximate the isochronous field are calculated. About 100,000 measured points have been evaluated; in the computer program the detection of erroneous points is emphasized. If possible these points are corrected by interpolation. (auth)

7388 ANALOGUE COMPUTER STUDIES FOR AN AVF CYCLOTRON. H. L. Hagedoorn and N. F. Verster (Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Nucl. Instr. Methods, 18, 19: 336-7(Nov. 1962). (In English)

An example is given of the application of an analogue com-

puter to the investigation of orbits in an AVF cyclotron. (auth)

7389 CENTER-REGION GEOMETRY OF THE BERKELEY 88-INCH CYCLOTRON. H. A. Willax and A. A. Garren (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 347-61(Nov. 1962). (UCRL-10071). (In English)

In order to determine the proper position of the dee edge, ion source, puller, and beam-defining clipper with respect to the magnet center, measurements of the structure of the electric field in the surroundings of the ion source were made with a half-scale model in an electrolytic tank. The acceleration process during the first three revolutions was studied for different geometries and starting phases, by a graphical approximation method for orbit plotting. A more detailed study was then made to determine initial conditions—such as orbit-center distribution, energy spread, axial focusing, and energy bunching—as functions of the center geometry and starting phase. By increasing the particle path length during the first half revolution approximately 20 deg—achieved by azimuthal displacement of the source—good results were obtained. The ion-start location was finally determined so as to bring the beam close to an equilibrium orbit at 10 in. radius. This was done with an orbit code, modified to take account of the increased transit time through the acceleration gap of smaller radii. Some experimental results of changes in the cyclotron beam quality, caused by changes in the ion-starting conditions, are presented. (auth)

7390 DEVELOPMENT OF THE MAGNETIC CONE FOR THE CENTER OF THE BERKELEY 88-INCH CYCLOTRON. P. G. Watson (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 362-9(Nov. 1962). (UCRL-10072). (In English)

General requirements for a vertically focusing negative magnetic gradient region near the cyclotron center are stated. Cone shapes were studied with computer program CENREG (IBM 704) and with magnetic measurements in a fifth-scale model magnet. Principal parameters studied were vertical and radial focusing, particle phase slip, and magnetic first harmonic. Shaping of iron to achieve the desired conical field profile in conjunction with circular trim coils is described. A pattern of holes with magnetically saturated iron caps in the 8-in.-diam center plug was needed to get the desired cone shape at all field levels from 8 to 16 kG. Proper placement of holes and modification of the movable ion-source hole in the upper pole tip was necessary to reduce first harmonic at 5 in. radius to less than 2 G at all field levels and at all ion-source positions. Small adjustments of center-region iron were made during full-scale magnet testing. Cyclotron operations to date have shown the choice of center cone to be very satisfactory. (auth)

7391 THE ROLE OF THE PION FACTORY IN ELEMENTARY PARTICLE PHYSICS. R. P. Haddock (Univ. of California, Los Angeles). Nucl. Instr. Methods, 18, 19: 387-96(Nov. 1962). (In English)

A very relevant question concerns the usefulness of the pion factory. Some light is shed on this question by considering (1) the mechanism of production of pion beams and (2) the research requirements to complete programs in elementary particle physics. This paper presents a brief review of these two considerations. Some conclusions are reached concerning the desired energy and current of the pion factory. (auth)

7392 COMPARISON OF ACCELERATOR TYPES. Lloyd Smith (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 397-404(Nov. 1962). (In English)

A number of characteristics of accelerators relevant to their use as "meson factories" are discussed and a comparison made of various types on the basis of these properties. In addition to the most popular types for this application—the isochronous cyclotron and the linear accelerator—the f.m. cyclotron, alternating gradient synchrotron, FFAG synchrotron, and electron accelerators are discussed briefly with respect to various attractive features concerning energy, intensity, duty factor, extraction, and cost. (auth)

7393 SHIELDING AND ACTIVATION CONSIDERATIONS FOR A MESON FACTORY. Roger Wallace (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 405-16(Nov. 1962). (UCRL-10086). (In English)

The shielding and activations of a meson factory are estimated by computing the emission spectra of the neutrons produced, and using these spectra to estimate the necessary shielding and the probable activation of the accelerator caused by the captured neutrons. The technique used in making these estimates is explained. It is assumed that a meson factory has an internal circulating beam current of 100 μA of 450-, 600-, or 850-Mev protons. This beam will be assumed to hit an aluminium target of 100 g/cm^2. (auth)

7394 PROPOSAL FOR A CONSTANT-FREQUENCY SECTOR-FOCUSSED CYCLOTRON FOR PROTONS OF 450 Mev. J. P. Blaser (Eidgenossiche Technische Hochschule, Zurich) and K. Steimel. Nucl. Instr. Methods, 18, 19: 417-24(Nov. 1962). (In English)

The purpose is the production of high intensity nucleon and meson beams for precision experiments in the lower energy region. High intensity can only be achieved practically by producing the mesons on an external target. Extraction rates of ≥50% are driven at and internal losses should be limited to ≤20μA in order to avoid too complicated remote control. Lay-out provides first shielding immediately around machine, either by pot-shaped yoke with forevacuum inside, or removable concrete. Production target is close to machine inside main shielding. Bending magnets have to be imbedded in shield wall to avoid beam contamination. For experimental flexibility experimental hall of 40 × 40 m is below level but not underground. The cyclotron would have 6 spiral sectors (max. angle 65-70°) with max. field of 21 kgauss. Two 90° dees with a $\frac{1}{4}$ λ mode are excited through the center at the second harmonic to provide acceleration of >200 kv per turn. Ion optical devices in center limit oscillation amplitudes to very low values. Maximum energy is tentatively chosen at $\mu_r = \frac{3}{2}$ resonance which shall be used for extraction. For meson physics, higher energy would be considerably better, but attempt of passing resonance may diminish chances of high extraction rates. (auth)

7395 ON THE DESIGN OF AN ISOCHRONOUS CYCLOTRON MESON FACTORY. M. Barbier, P. Lapostolle, M. Morpurgo, and N. Vogt-Nilsen (European Organization for Nuclear Research, Geneva). Nucl. Instr. Methods, 18, 19: 425-37(Nov. 1962). (In English)

A fixed energy high beam intensity isochronous cyclotron for meson production is under consideration at CERN, Geneva. A convenient and rapid method is described for determining suitable spiral ridge fields giving a chosen variation of the linearized vertical betatron oscillation frequency versus energy. The method implies an approximation of the field ridges into a prechosen number of small hard-edged steps. Some computational results are discussed and a preliminary choice of machine parameters given, as well as a conceptional design of the field magnet and the general layout of other major machine components.

The problem of shielding is discussed. A series of shielding studies involving experiments carried out at 400 Mev on the CERN Synchro cyclotron are described and some results are quoted. Finally, a description is given of a series of irradiation and activation experiments involving samples of various materials placed inside the CERN SC. (auth)

7396 CONCEPTS OF AN Mc^2 CYCLOTRON. R. S. Livingston, E. D. Hudson, R. J. Jones, R. S. Lord, J. E. Mann, J. A. Martin, F. M. Russell, N. F. Ziegler, and A. Zucker (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 438-46(Nov. 1962). (In English)

A source of high energy proton and π and μ mesons of unprecedented intensity should result from a large isochronous cyclotron now under study. An intense beam of protons at approximately 800 Mev can be deflected from this eight-sector machine at the 8/4 resonance. Model studies have also shown that internal beams with energies above Mc^2 are possible. The maximum orbit radius is 6 m (20 ft); the outer radius of the machine is 9 m. From the design of a 0.15 scale model, with three of the eight sectors, it is estimated that the full scale magnet would require about 5000 tons of steel and 10 Mw of magnet power. R.f. excitation by resonant cavity is planned, with several possible configurations under study. Shielding of experimental areas of adequate size will require use of earth or compacted aggregate to achieve reasonable economy. Studies of induced activity suggest that the use of aluminium, iron, and carbon in strategic areas and the elimination of nickel and perhaps a few other materials, will make management of activity levels feasible. (auth)

7397 CONSIDERATIONS ON THE DESIGN OF A SPIRAL RIDGE CYCLOTRON FOR 450 Mev PROTONS. W. Müller and W. Wolff (AEG Forschungs-Institut, Frankfurt am Main). Nucl. Instr. Methods, 18, 19: 447-56(Nov. 1962). (In English)

The possibilities of field pattern design for a high energy cyclotron are considered under the assumption, that the magnetic field in the median plane in azimuthal direction is given by solutions of the two-dimensional linear potential equation. For some cases the radial dependence of the radial and axial oscillation numbers and of the field parameters is calculated and discussed. (auth)

7398 PRELIMINARY CONSIDERATIONS ON MESON CYCLOTRONS. J. Reginald Richardson (Univ. of California, Los Angeles). Nucl. Instr. Methods, 18, 19: 457-60 (Nov. 1962). (In English)

The design criteria for cyclotrons producing large fluxes of π and μ mesons are discussed. A sample design for the acceleration of protons to 700 Mev is described. The dees are placed in the valleys, which are made three times as wide as the hills. This geometry gives optimum focusing and results in a relatively weak average magnetic field, and this in turn leads to a magnet design which is relatively inexpensive in copper, steel, and power. (auth)

7399 BEAM CHARACTERISTICS IN CYCLOTRON ANALOGUE II. J. A. Martin and J. E. Mann (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 461-8 (Nov. 1962). (In English)

The beam characteristics of the eight-sector fixed-frequency electron cyclotron, Analogue II, are analyzed. The Analogue accelerates electrons to beyond the integral resonance $\nu_r = 2$, which occurs at an energy of 443 kev. The resonance previously identified as the radial resonance $\nu_r = 4/3$ is actually the difference coupling resonance $\nu_r - \nu_z = 1$. All evidence of this resonance is eliminated by precise cancellation of the horizontal component of the earth's magnetic field. The tendency for the beam to move away from the median plane near maximum radius and the large amplitude axial motion at the sum coupling resonance $\nu_r + \nu_z = 2$, were both found to be associated with a distorted median plane. The effects can be largely eliminated by a slight unbalance of the currents in the upper and lower halves of the circular coils which produce the average magnetic field. A new measurement of the minimum dee voltage required to accelerate electrons to full energy gave a value of 60 volts rms. This indicates a maximum energy gain of 170 ev/turn; at least 2600 turns are achieved. A beam current of a few microamperes at full energy is obtained with a dee voltage of 180 v rms. (auth)

7400 REMARKS ON TUNE-UP OF ANALOGUE II. R. J. Jones (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 469-71(Nov. 1962). (In English)

A successful knob-turning experiment in determining the 35 separate coil current setting required for the full-radius operation of Analogue II is described. (auth)

7401 RADIATION SURVEY AT THE LRL 184-INCH CYCLOTRON. R. W. Boom, K. S. Toth, and A. Zucker (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 472-8(Nov. 1962). (In English)

To predict the radioactivity problems to be anticipated with a high-intensity, Mc^2 accelerator, the residual and induced radioactivities were measured at the 184-Inch Berkeley cyclotron during November 1960. The five-day study included a general survey of radiation levels in the cyclotron vault, short-time activation of foils placed near the cyclotron, and analysis of γ-ray spectra of the cyclotron gap region, including dee structure. Initial radiation levels were less than 8 r/hr; these dropped to about 10 mr/hr after 48 hr. The induced activities in foils were: Cu^{64} and Co^{58} in copper, Mn^{52}, Mn^{54}, and Mn^{56} in iron; and Na^{24} in aluminum. The γ-ray spectra from the gap region show two intense long-lived peaks at 510 and 810 kev, probably from Co^{58}. Foils of aluminum, brass, copper, nickel, and steel were then attached to one of the pole pieces and left in the cyclotron for one year. The γ-ray spectra of these foils were later analyzed for the presence of induced long-lived activities. The foils can be grouped in order of increasing amount of induced activity at saturation bombardment as follows: aluminum, copper, brass, steel, and nickel. The preliminary conclusion is that with proper precautions a 100-μA Mc^2 cyclotron could have a long-lived background less than 1 r/hr. (auth)

7402 A PROPOSAL FOR LINEAR REGENERATIVE EXTRACTION FROM THE BIRMINGHAM RADIAL-RIDGE CYCLOTRON. E. A. Finlay (Univ. of Birmingham, Eng.). Nucl. Instr. Methods, 18, 19: 479-87(Nov. 1962). (In English)

This machine is intermediate between a conventional cyclotron and synchrocyclotron as far as separation of successive orbits is concerned. Substitution of the appropriate values of ν_r and ν_z in Le Couteur's linear theory gave results which appeared to justify more detailed computation. This was carried out in two stages. The first stage was concerned with the validity of this theory when the machine has a periodic structure, when the peeler and regenerator fields have curved "toes", and when the dee voltage is applied. It was restricted to radii at which flux-fringing was inappreciable. An idealized model of the magnetic field, which assumed a trapezoidal azimuthal variation, was used throughout. Several sets of trajectories, each comprising approximately 40 orbits, were computed.

Differences from the results of the simple theory were considerable, but not such as to destroy its usefulness. The second stage was concerned with the crucial question of the effects of flux-fringing. It consisted of a similar set of calculations at larger radii. The results show that suitable turn separations combined with vertical stability may be obtained at radii large enough to permit extraction. An estimate of extraction efficiency is given. In the interest of flexibility, it is intended that electrostatic devices will be used for the peeler, regenerator, and deflector channel. (auth)

7403 BEAM EXTRACTION FROM THE UNIVERSITY OF ILLINOIS SECTOR-FOCUSSED CYCLOTRON. M. K. Brussel, J. S. Allen, and L. E. Ernest (Univ. of Illinois, Urbana). Nucl. Instr. Methods, 18, 19: 520-4(Nov. 1962). (In English)

Protons have been extracted in the energy range 5 to 15 Mev from the University of Illinois spiral ridge cyclotron. A new extraction system has been constructed consisting of a primary electrostatic deflector capable of maintaining a voltage of 100 kv, a secondary quadrupole deflector which radially focusses a beam by electrostatic and magnetic means, and a third electrostatic steering deflector. Four quadrant coils are required for proper delivery of the internal beam into the deflection system. Except near 15 Mev, where the thickness of the primary deflector septum limits the extraction efficiency, approximately 5% of the internal beam can be focussed into a spot approximately 1 cm^2 in area in the experimental area 25 ft from the cyclotron. The external beam has an energy spread of approximately 100 kev; a divergence of ±0.002 radians horizontally and a divergence of ±0.003 radians vertically when no external focussing elements are present. Beam currents of 200 μA at an extraction radius of 47 cm have been routinely utilized. (auth)

7404 ELECTROSTATIC DEFLECTOR CALCULATIONS FOR THE BERKELEY 88-INCH CYCLOTRON. A. A. Garren, D. L. Judd, L. Smith, and H. A. Willax (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 525-47(Nov. 1962). (UCRL-10067(Rev.)). (In English)

Early computer calculations showed that an electrostatic channel would have to be very narrow to cause sufficient deflection at high energy. One alternative considered was a system of three electrostatic channels in series, acting as a one-turn regenerative extractor. Such a system could easily achieve the required deflection, but at the expense of simplicity. A magnet channel to reinforce the electrostatic channel likewise appeared difficult for a variable-energy machine. Detailed studies of a simple electrostatic channel began with development of an analytic-graphical method of calculating channel efficiency. By this method one can estimate acceptance as a function of radial turn separation, amplitude and frequency of radial oscillations, and channel geometry. A computer code was then developed to compute channel shapes and calculate acceptance more accurately by following the fate of a representative sample of orbits in the presence of the channel. Use of this code indicated that highest acceptance would be obtained if the channel entrance is set out at 39 in. provided the resonances at $\nu_r = 1$ and $\nu_r = 2\nu_z$ could be safely traversed, as was believed possible. Some calculations on transition through the $\nu_r = 2\nu_z$ resonance are presented. (auth)

7405 MECHANICAL FEATURES OF THE ELECTROSTATIC DEFLECTOR FOR THE BERKELEY 88-INCH CYCLOTRON. Ralph Peters (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 552-8(Nov. 1962). (UCRL-10066). (In English)

The mechanical features of the electrostatic deflector are described. The deflector channel starts as close as possible to the dee. It must deflect the particles enough to clear the leg of the magnet. The channel width at entrance is $\frac{5}{32}$ in. (0.4 cm) and at exit is $\frac{1}{2}$ in. (1.2 cm). The nominal voltage is 63 kv. The deflector is 108 deg long. It is built of four segments, two in the outer high-voltage element and two in the inner ground element. The channel elements are water-cooled welded Inconel. Each of the two high-voltage elements is separately cantilevered from an insulating bushing. The whole assembly is built like a drawer. The floor of the drawer is a $\frac{1}{2}$-in. sheet of K-Monel. Bearings throughout are Teflon-impregnated sintered bronze. A moving $\frac{1}{4}$-scale model of the deflector elements is installed in the control room. It reproduces automatically all motions of the deflector in the cyclotron. The initial deflector is equipped with a standard metal fixed septum. A sawmill septum is being developed to replace the standard septum when and if desired. This sawmill septum consists of two metal rotating disks. (auth)

7406 DESIGN AND DEVELOPMENT OF THE ION SOURCE FOR THE BERKELEY 88-INCH CYCLOTRON. K. W. Ehlers (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 571-5(Nov. 1962). (UCRL-10080). (In English)

The ion source enters the cyclotron through the upper pole tip. A large first-harmonic perturbation of the magnetic field, which would result from the presence of the entrance hole through the pole tip, has been avoided by incorporating iron within the source structure. The ion source utilizes the hot-filament Penning type of discharge, and has been designed to operate with a variety of gases, including such heavier gases as nitrogen and oxygen. By operating a test source in a mass-spectrometer arrangement, spectra of the extracted ion output have been obtained. The design and operating characteristics of the ion source are discussed. (auth)

7407 TRIM-COIL CONSTRUCTION FOR THE BERKELEY 88-INCH CYCLOTRON. L. R. Glasgow and R. J. Burleigh (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 576-81(Nov. 1962). (UCRL-10082). (In English)

A detailed description of the mechanical construction of the trim coils is presented. It includes selection, optimization, and application of a suitable electrical conductor for use under severe radiation conditions, brazing considerations for a very large furnace brazing job, and a discussion of some of the problems encountered during the fabrication procedures. (auth)

7408 UNIVERSITY OF COLORADO 52 INCH CYCLOTRON DEE DESIGN. Rodman Smythe (Univ. of Colorado, Boulder). Nucl. Instr. Methods, 18, 19: 582-3(Nov. 1962). (In English)

A dee with a useful aperature 49.5 in. in diameter by 1.29 in. high has been built. The external height is 2.00 in. The 0.35 inch thick top and bottom panels consist of 0.062 in. copper conductor which is cooled by water in 0.375 in. copper tubing, flattened to 0.25 in. The inside surface of the panel is 0.040 inch stainless steel–copper laminate. The panel assembly was brazed in a vacuum retort into a single piece. Atmospheric pressure was utilized to jig the parts during brazing. The entire exterior surface of the dee (including the two flat panels) is water cooled copper sheet, which has been welded and brazed into a single surface. The interior structural frame is stainless steel. (auth)

7409 BEAM-TRANSPORT SYSTEM FOR THE BERKELEY 88-INCH CYCLOTRON. Hugo Atterling (Univ. of

California, Berkeley). Nucl. Instr. Methods, 18, 19: 589-94(Nov. 1962). (UCRL-10077). (In English)

The facilities for focusing and bending the external beam are described, mainly from an ion optical point of view. Particular attention is paid to a bending system that has been designed to deflect the beam through an angle of 104 deg in order to guide it into the cave provided for high-intensity bombardments. Some numerical results of ion optical calculations are presented. (auth)

7410 BEAM-PHASE MEASUREMENT STUDIES. W. H. White, Jr., B. Duelli, and R. J. Jones (Oak Ridge National Lab., Tenn.). Nucl. Instr. Methods, 18, 19: 601-5 (Nov. 1962). (In English)

A non-intercepting system was developed for measuring the phase of the internal beam of a cyclotron with respect to the r.f. voltage on the dee. The system has been used during initial tests of the Oak Ridge Isochronous Cyclotron to improve the isochronous field shape. It will also be used in beam studies and during operation to provide data to improve the computed setting of the trimming coils. Beam pulses are detected on an electrostatic pickup probe. The differentiated waveform is presented on a sampling oscilloscope from which the width and shape of the beam pulse can be deduced. The system is sensitive to average beam currents to below 10 μA; average beam currents up to 1 mA have been observed. The precision of phase measurements can extend to 2 deg at 22.5 Mc/sec. The probe design criteria, circuitry, and some results are discussed. (auth)

7411 A METHOD TO INCREASE THE DUTY FACTOR OF AN ISOCHRONOUS CYCLOTRON. Tat K. Khoe (Argonne National Lab., Ill.). Nucl. Instr. Methods, 18, 19: 606-9 (Nov. 1962). (In English)

A method to increase the duty factor of an isochronous cyclotron is suggested. This method, which increases the duty factor to approximately 50%, requires a modulation of the frequency of the dee-voltage. The required amplitude and rate of modulation are determined. (auth)

7412 APPLICATION OF SILICON DIODES TO CYCLOTRON OSCILLATOR AND MAGNET POWER SUPPLIES. W. L. Dexter and B. H. Smith (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 613-21(Nov. 1962). (UCRL-10020). (In English)

Silicon diodes have proved to be convenient and reliable in all types of power supplies throughout the Berkeley 88-inch cyclotron. The paper includes practical design data, a discussion of the pitfalls our experience has taught us to avoid, and comparison of silicon power supplies with other types of power supplies with respect to cost and performance. (auth)

7413 FERROELECTRIC MODULATORS. H. Brueckmann (Universität, Bonn). Nucl. Instr. Methods, 18, 19: 622-6(Nov. 1962). (In English)

There are several methods by which the high frequency of a cyclotron can be modulated. Almost all of these require the mechanical alteration of capacities. One particular method is described which utilizes the specific properties of ferroelectric crystals and the properties which are most important for the design and operation of a ferroelectric modulator are mentioned. (W.D.M.)

7414 BUILDING, SITE, UTILITIES AND SERVICES FOR THE BERKELEY 88-INCH CYCLOTRON. T[orleif] H. Myhrer and W[illiam] P. Carpender (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 627-33(Nov. 1962). (UCRL-10079(Rev.)). (In English)

The development of the building project and its adaptation to requirements imposed by site, time schedule, and the accelerator is described. Included are such matters as the allocation and organization of building space in relation to accelerator operation and research function, provision for possible future changes, and the influence of the selected site and its topography on the building design. Factors that determined the choice of materials are discussed. The types of utilities for present and planned future needs, especially the high-purity water systems, are summarized. A brief description is given of illumination and building colors. (auth)

7415 COSTS AND MANPOWER FOR THE BERKELEY 88-INCH CYCLOTRON. R[ichard] J. Burleigh (Univ. of California, Berkeley). Nucl. Instr. Methods, 18, 19: 634-8(Nov. 1962). (UCRL-10076). (In English)

Actual costs are presented for the Berkeley 88-inch cyclotron. Tables show occupational rates, cost summary, design costs, cost by major categories, detailed cost breakdown, and unit costs. Graphs show laboratory effort versus time. (auth)

7416 ELECTROMAGNETIC INFLECTOR FOR SYNCHROTRON INJECTION. H. Fechter (Univ. of Colorado, Boulder) and Martyn Foss. Rev. Sci. Instr., 33: 1277-8(Nov. 1962).

A short full-scale magnetic inflector was designed for beam injection into a synchrotron with minimum amplitude of vertical betatron oscillations. The cooling holes were found to have negligible effect on the field homogeneity. (D.L.C.)

7417 STABLE BETATRON OSCILLATIONS IN A NONLINEAR MAGNETIC FIELD. Yu. F. Orlov (Inst. of Physics, Academy of Sciences, Armenian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1308-14(Oct. 1962). (In Russian)

The stability is considered of betatron oscillations in an annular axial-symmetrical magnetic field with maximum (or minimum) along the radius r. In a linear approximation with respect to vertical z-oscillations, a potential well for r-oscillations is meaningful, inside which there exist bands of stability for z. The nonlinearity of small z-oscillations does not violate the stability. Acceleration without violation of stability is possible with strong focusing at the onset of acceleration. (auth)

7418 INVESTIGATION OF THE POLARIZATION PROPERTIES OF SYNCHROTRON RADIATION FROM HIGH ENERGY ELECTRONS. F. A. Korolev, O. F. Kulikov, and A. S. Yarov (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1653-6(Nov. 1962). (In Russian)

Data pertaining to the ratios of the intensities and the angular distribution of synchrotron radiation are obtained for both polarization components of the radiating electron by employing rapid cinematography of the synchrotron radiation emitted by electrons accelerated in the 680-Mev FIAN synchrotron. The relation between the real angular distribution of the radiation for the π-polarization component and the amplitudes of the axial electron oscillations is established. (auth)

Plasma Physics and Thermonuclear Processes

7419 (AD-274920) LO-TEMP THERMIONIC PLASMA STUDY. Yearly Summary Technical Report. (Ford Instrument Co., Long Island City, N. Y.). Jan. 31, 1962. Contract NONR 3416(00). 60p.

Measurements of electron temperature, electron concentration and space potential in the plasma region of low temperature thermionic converters were determined by means of a pulsed Langmuir probe technique. The spatial distributions of these parameters, in parallel plate geometry, were measured with the aid of movable probes. The experimental values are shown to be consistent with a reasonable physical picture. Preliminary results obtained from converters, in which small amounts of O_2 were present in the discharge region are explored. The effects of Cs and patch effects on the surface characteristics of impregnated W emitters are discussed on the basis of a theoretical analysis and experimental results with numerous test cells. (auth)

7420 (AD-275005) THEORETICAL INVESTIGATIONS AND DESIGN STUDIES FOR THE EVENTUAL CONSTRUCTION OF A MEASURING DEVICE IN THE FIELD OF PLASMA ELECTRONICS. PART II. CORRECTION OF ANGULAR AND RANGE ERRORS. Final Report, May 1, 1961–February 28, 1962. (Battelle Institut e.V., Frankfurt am Main). Apr. 15, 1962. Contract DA-91-591-EUC-1018. 99p.

Path ray and phase-transit time of a plane electromagnetic wave penetrating a cylindrical plasma zero < epsilon < 1 are determined by analogy with optics by means of a geometric-optical approximation. With a parabolic distribution of the electron density, the solution obtained by calculation yields simple formulations of the phase-transit time and the angle of the ray path. Range errors and angular errors for the rays penetrating the plasma cylinder near the symmetry axis are calculated for parabolic distribution of electron density, and compared with the values obtained by experiment. If the distribution of the electron density is not known, a method of approximation is used permitting the determination of the response of the phase front behind the plasma cylinder, and consequently of the angular error. The graphic representations show the relationship between the path parameters of a ray and the measured values of the absolute phase-transit-time difference and the relative phase-transit-time difference. (auth)

7421 (AFCRL-62-186) TRANSMISSION AND REFLECTION OF ARBITRARILY POLARIZED ELECTROMAGNETIC WAVES AT THE BOUNDARY OF AN ANISOTROPIC PLASMA. Scientific Report No. 1. K. A. Graf and M. P. Bachynski (RCA Victor Co., Ltd. Research Labs., Montreal). Jan. 1962. Contract AF19(604)-7432. 135p. (AD-276362)

The interaction of a plane, electromagnetic wave with a flat, uniform, freespace-plasma interface in a static magnetic field was considered for arbitrary angles of incidence. The dispersion relation for the plasma is a complex quartic equation which reduces to a quadratic if the static magnetic field and plasma boundary is orientated along any one of the rectangular coordinate axes. (These axes need not simultaneously be the same for the plasma and the magnetic field.) The analysis is greatly simplified by writing the boundary conditions in terms of the fields in the plasma, and for the model considered a rigorous solution was obtained. The solution indicates that two waves can be simultaneously supported by the plasma. These two waves are, in general, ellipitically polarized, plane, and nonhomogeneous. Either wave can be launched by a suitable elliptically polarized, plane incident wave. Superposition of these waves, each of which gives one plasma wave, is a simpler procedure than superposing plane or circulatory polarized waves, each of which gives rise to two waves. Although the field vectors associated with the two waves in the plasma can be superimposed, the energy carried in each wave cannot since the two waves interfere within the plasma. (auth)

7422 (AWRE-0-11/62) 8 MM MICROWAVE MEASUREMENTS ON PRECURSOR AFTER-GLOW IONISATION IN A HYDROMAGNETIC SHOCK TUBE. J. A. Russell, B. L. Elphick, M. W. Alcock, and J. Daniels (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). May 1962. 34p.

The use of a combined transmission and interferometer system to measure the electron density and electron collision frequency in the ionization associated with the precursor excitation and with the shock front afterglow are described. Measurements on deuterium and argon gas pressures within the range 5–100 μHg are reported. The presence of precursor ionization was confirmed. (auth)

7423 (D1-82-0211) FINITE AMPLITUDE INSTABILITY OF THE POSITIVE COLUMN. Oeivin Holter (Bergen. Universitetet) and Boeing Scientific Research Labs., Seattle). Nov. 1962. 20p.

The theory of Johnson and Jerde for the instability of the positive column was extended to include oscillations of finite amplitudes. The method followed in the approximate solutions of the non-linear equations is the one suggested by Kadomtsev and Nedospasov. The stability condition is expressed in terms of an amplitude factor giving the rate at which the diffusion increases in the presence of the finite amplitude oscillations. The theory developed was combined with the diffusion theory of Lehnert, and the electric field was calculated as a function of tube radius × magnetic field. The results are in good qualitative agreement with the experimental results found by Hoh and Lehnert up to magnetic fields several times higher than the critical field. (auth)

7424 (DCAS-TDR-62-42) EQUILIBRIUM SOLUTIONS OF A PLANE ELECTRON BEAM IN A PLASMA. Chieh Chien Chang (Aerospace Corp. Physical Research Lab., El Segundo, Calif.) and Thomas S. Lundgren (Minnesota Univ., Minneapolis). Feb. 1, 1962. Contract AF04(647)-930. 35p. (AD-274645; TDR-930(2230-05)TN-4)

Equilibrium solutions of an electron beam injected into a plasma are considered. This is a preliminary step in studying the stability of the so-called E-layer of the Astron thermonuclear reactor. The model consists of a plane sheet of streaming electrons in a homogeneous plasma. Equilibrium solutions were obtained from the collisionless Boltzmann equations for three fluids: one of stream electrons, another of plasma electrons, and a third of plasma ions. Two important cases are treated in this manner: cold plasma and cold beam. The distribution of beam electrons, plasma ions, and plasma electrons is presented. (auth)

7425 (MATT-77) THE SHEATH CRITERION. Francis F. Chen (Princeton Univ., N. J. Plasma Physics Lab.). June 13, 1961. Contract AT(30-1)-1238. 14p.

It was shown that ions arriving at a sheath on a negative electrode or wall must have energy greater than or equal to $\frac{1}{2}$ kTe, however there was doubt as to the validity of this criterion. A discussion is presented to show that this sheath criterion is valid for a wide range of conditions. That the ion velocity near a boundary should be given by the electron, rather than the ion temperature, is physically reasonable when kTe $\gg$ kTe, since the force driving the ions into the wall is provided by the plasma pressure $n_0 kT_e$. (J.R.D.)

7426 (MATT-92) EFFECT OF CHARGE EXCHANGE ON ION DRIFT VELOCITY IN ELECTROMAGNETIC

FIELDS. W. L. Harries (Princeton Univ., N. J. Plasma Physics Lab.). Aug. 1961. Contract AT(30-1)-1238. 15p.

The drift velocity of ions in crossed electric and magnetic fields, when charge exchange predominates, is derived. The result depends on whether the ion cyclotron frequency is greater or less than the ion-neutral collision frequency. In both cases a mobility is found, based on a simple picture of ion particle velocity. (auth)

7427 (NP-12296) EXPERIMENTAL AND THEORETICAL STUDIES OF MHD SHEAR HEATING. Final Report. (Plasmadyne Corp., Santa Ana, Calif.). Sept. 1962. Contract Nonr-3518(00). 33p.

The feasibility of magnetohydrodynamic shear heating, which occurs at the interface of two counter-rotating layers of plasma, for rapidly heating a confined plasma was investigated. The experimental apparatus consisted of a pyrex glass "T" chamber where observations were made and two coaxial guns inject plasma into the glass chamber. A smear camera was used to investigate the velocities of the luminous region. A microwave reflectometer was used to estimate the free electron densities. The smear camera photographs of the colliding plasmas seemed to indicate a possibility of shear heating. However, the tenuousness of the interacting plasmas used in these studies enabled them to interpenetrate and puncture before any significant interaction was observed. (M.C.G.)

7428 (NP-12342) OBSERVATION OF INSTABILITIES IN A PLASMA INJECTED INTO A B_z FIELD. Alan J. Toepfer (Aerospace Corp. Physical Research Lab., El Segundo, Calif.). Nov. 1, 1962. Contract AF 04(695)-169. 22p. (SSD-TDR-62-146; TDR-169(3210-02)TN-I).

Photographic observations were made of a plasma blob injected into a non-varying axial magnetic field. The plasma was axially confined for periods of time up to three microseconds, after which instabilities developed. Radial accelerations of the plasma-magnetic field boundary were estimated to be an order of magnitude less than in recent thera pinch experiments. Initial conditions at the plasma-magnetic field boundary indicated the possibility of the development of the flute, or interchange, instability. (auth)

7429 (TID-17336) COLLECTIVE MOTION IN A BEAM-PLASMA SYSTEM. B. N. A. Lamborn (Florida. Univ., Gainesville). Nov. 15, 1962. Contract AT(40-1)-2783. 21p.

By describing systems composed of a plasma and a set of moving charged particle streams by means of collective coordinates, it is possible to discuss the collective interactions of the components of the system. In the method used, each species of particles is divided into streams, such that all particles belonging to a stream have a unique mass, charge, and mean velocity, except for thermal variations. The equations of motion for the Fourier coefficients of the collective coordinates representing each stream can then be derived by using a Fourier-transform method. This approach is valid when the frequency of the short-range collisions is small relative to the characteristic time associated with the collective motions. In this limit, the short-range collisions will act as a damping mechanism, limiting the amplitudes of the collective modes. However, the effect of this damping is not specifically taken into account in the treatment. The waves associated with different collective modes of the streams can be scattered by each other, thereby transferring energy from one mode of the system to another. (auth)

7430 (UCRL-6387) LAGRANGIAN AND HAMILTONIAN METHODS IN MAGNETOHYDRODYNAMICS. William A. Newcomb (California. Univ., Livermore. Lawrence Radiation Lab.). June 12, 1961. Contract W-7405-eng-48. 41p.

The Lagrangian and Hamiltonian formulations of classical dynamics were applied to the motion of an infinitely conductive plasma with a frozen-in magnetic field. Two separate cases were considered, one with a scalar plasma pressure and one with a tensor. The treatment of the former was based on the conventional hydromagnetic equations, and that of the latter on the modified hydromagnetic equations of Chew, Goldberger, and Low. In each case the plasma equation of motion was derived, in either the Lagrangian or the Eulerian form, from a variational principle, with the other hydromagnetic equations functioning as holonomic constraints. The general formalism was applied, for purposes of illustration, to the solution of hydromagnetic stability problems. A derivation of the hydromagnetic energy principle is given, and then the energy principle was adapted to steady flows of a certain special type. (It was originally designed only for static equilibria.) Specifically, it was adapted to purely azimuthal steady flows around a symmetry axis, with the frozen-in field either purely toroidal or purely poloidal; and for these it gives the necessary and sufficient condition for m = 0 stability (stability against small perturbations that do not destroy the symmetry). This type of steady flow is a hydromagnetic analogue of Couette flow, and the stability conditions are generalizations of Rayleigh's condition. (auth)

7431 (UCRL-6561) P-4, A STEADY-STATE PLASMA SYSTEM. Laurence S. Hall and Andrew L. Gardner (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 27, 1961. Contract W-7405-eng-48. 21p.

A system is described which produces a steady-state He plasma with greater than 95% ionization. The primary plasma is generated in a modified PIG discharge and diffuses along a magnetic field (B ~ 1 kilogauss) through a region in which neutral particles are preferentially removed. In the downstream region a plasma density of $\sim 2 \times 10^{13}$ cm^{-3} and ion temperatures up to 10 ev were achieved. A description is given of the overall physical assembly, the operating characteristics of the system, and the nature of the plasma that is produced. In addition, a discussion of processes believed important in its operation is given. (auth)

7432 (UCRL-6562) DIAGNOSTIC MEASUREMENTS ON THE P-4 STEADY-STATE PLASMA. Andrew L. Gardner, William L. Barr, Raymond L. Kelly, and Norman L. Oleson (California. Univ., Livermore. Lawrence Radiation Lab.). Oct. 24, 1961. Contract W-7405-eng-48. 33p.

Techniques and results are given for various measurements made on a helium plasma in the P-4 steady-state plasma system (which employs a longitudinal magnetic field of approximately one kilogauss). Neutral particle pressures ranged from about 3×10^{-4} mm Hg near the source to about 10^{-5} mm Hg in the downstream region. Spectroscopic measurements showed principal impurities were C, N, and O ions (up to C^{+++}, N^{++++}, and O^{++++} states). Doppler broadening measurements of He^{+} λ4686 revealed ion temperatures up to 10 ev. Probe measurements indicated electron temperatures up to 20 ev and maximum ion densities of a little over 10^{13} cm^{-3}. Microwave transmission measurements (at λ = 4 mm and 8 mm) gave supporting evidence that the electron density exceeds 10^{13} cm. (auth)

7433 (UCRL-9971) HYDROMAGNETIC IONIZING FRONTS. Wulf B. Kunkel and Robert A. Gross (California.

Univ., Berkeley. Lawrence Radiation Lab.). Dec. 14, 1961. Contract W-7405-eng-48. 37p.

One of the techniques by which highly ionized plasmas can be generated in the laboratory makes use of strong, electromagnetically driven shock waves propagating into a cold gas. If a magnetic field already exists in the undisturbed region these shocks will in general not be gasdynamic in character but the current-carrying interface will coalesce with the ionizing front. The process has certain features in common with detonation waves, and differs from previously analyzed hydromagnetic shocks in that the electric field in the undisturbed region need not vanish. If the initial magnetic field has a longitudinal component the gas must be permitted to acquire a transverse velocity. Moreover, since such shocks are almost always compressive, the plasma will usually also have a forward velocity. In closed-end tubes, therefore, the front must be followed by a rarefaction wave in which the longitudinal flow is brought to rest again. The phenomenon is analyzed as a one-dimensional single-fluid hydromagnetic problem, neglecting dissipation behind the wave. Zero conductivity is assumed for the region in front of the wave, and thermodynamic equilibrium is required behind. The problem is not determined unless an additional condition is imposed. We hypothesize that the rarefaction wave remains attached to the front. In the limit of essentially complete ionization behind the front, the problem can be solved analytically as long as the transverse magnetic field there remains small compared with the longitudinal field. In this case the front velocity, plasma density and temperature, and the electric fields—as well as the structure of the rarefaction wave—can be expressed as simple functions of the initial magnetic field, the discharge current, the ionization energy, and the initial gas density. It is of particular interest to note that in this limit the compression is found to be very modest [$\rho_2 = \rho_1(\gamma + 1)/\gamma$], and the trailing edge of the rarefaction wave propagates at half the speed of the front. It is also possible to generate noncompressive ionizing waves, provided that the magnetic field in the undisturbed region has a transverse component that is being appropriately reduced by the driving current flowing in the ionizing front. (auth)

7434 (UTIA-REV-18) A STATE-OF-THE-ART SURVEY OF SOME ASPECTS OF THE MECHANICS OF RAREFIED GASES AND PLASMAS. Interim Report No. 2. G. N. Patterson (Toronto. Univ. Inst. of Aerophysics). Mar. 1962. Contract AF33(616)-6990. 158p.

A state-of-the-art survey of the mechanics of rarefied gases and plasmas is presented including information on properties of molecules and their motion, distribution function, molecular scattering, properties of molecular collisions, the Boltzmann equation, Maxwell transfer equations, molecular equilibrium and entropy, the Boltzmann equation for free-molecule flow, reflection phenomena, orifice pressure probe, free-molecule aerodynamics, free flux in a tube, molecular beams, the Boltzmann relation as an integral equation, kinetic model of the Boltzmann equation, basic equations for an isolated body in near-free-molecule flow, properties of charged particles in electric and magnetic fields, field equations, four-potential, Hamilton's canonical equations, relativistic Boltzmann equation for collision-free ensemble of charged particles, and nonrelativistic Boltzmann equation—collisions, equilibrium state. (auth)

7435 (AEC-tr-5564) EXPERIMENTS ON MICROWAVE EMISSION AT CYCLOTRON HARMONICS OF A COLD PLASMA. [PART] I. Kenji Mitani, Hiroshi Kubo, and Shigetoshi Tanaka. Translated for Oak Ridge National Lab., Tenn., from Kaku Yugo Kenkyu, 9: 267-304 (Sept. 1962). 44p.

Studies were made of radiation of many higher order cyclotron harmonics which appear in the microwave radiation emitted from hot-cathode d-c arc discharges in a magnetic field. All the rare gases were investigated and it was found that this phenomenon is independent of the kind of gas used in the experiment. A fundamental was found in addition to the higher harmonics and the magnetic fields for the appearance of each harmonic shifted slightly from the theoretical value. The intensity of the harmonics did not change significantly when the harmonic became of a higher order. (M.C.G.)

7436 (NP-tr-928) THE STABILITY OF A SPATIALLY INHOMOGENEOUS PLASMA IN A MAGNETIC FIELD. A. B. Mikhailovskii and L. I. Rudakov (Akademiya Nauk S.S.S.R. Institut Atomnoi Energii). Translated by J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.). 1962. 14p.

An investigation was made of oscillations and stability of an inhomogeneous plasma in a magnetic field, without assuming that the Larnor radius of the ions is small compared with the wavelength. The discussion is based on the example of a plane layer of low-pressure plasma in a uniform magnetic field, using the Boltzmann equation but neglecting collisions. It is shown that, in a plasma with non-uniform density and temperature, there exist perturbations which are unstable for an arbitraity small degree of inhomogeneity and for any ratio of density and temperature gradients. Perturbations are unstable whose wavelengths along the magnetic field are greater than the characteristic distance a of variations of density or temperature. The transverse wavelength for the most unstable perturbations is of the order of or less than the Larnor radius of the ions. In a homogeneous plasma these perturbations correspond to ion-acoustic and Alfvén oscillations propagated almost transversely to the magnetic field. The maximum increment of the instability found was $\sim\sqrt{(Ti/Ma^2)}$. (auth)

7437 THE HALL EFFECT IN THE POSITIVE COLUMN OF AN ELECTRICAL GASEOUS DISCHARGE IN HELIUM. John M. Anderson (General Electric Research Lab., Schenectady, N. Y.). Appl. Phys. Letters, 1: 35-7 (Oct. 1962).

Determination of electron density in the positive column of an electrical gaseous discharge in helium is made using the Hall effect, microwave techniques, and measurements of positive ion current to the container wall. Data reveal that Hall effect and microwave values agree more closely than ion current and Hall effect values, perhaps as a result of difficulties in the interpretation of wall probe data. (D.C.W.)

7438 NOTE ON THE POYNTING VECTOR IN A PLASMA. Oeivin Holter. Arbok Univ. Bergen, Mat.-Nat. Ser., No. 13, 1-7(1961). (In English)

A low-frequency electromagnetic wave is considered that is propagating in a multicomponent plasma. The wave normal is assumed to be directed at a nonzero angle ϕ with respect to the direction of the external magnetic field. The angle (θ) between the wave normal and Poynting vector of this wave is found as a function of ϕ and the plasma's refractive index. The expression found for θ is identical to that for propagation in an electron plasma. (T.F.H.)

7439 RADIATIVE THERMAL CONDUCTIVITY OF COMPLETELY IONIZED HYDROGEN PLASMA. T. D.

Kuznetsova and D. A. Frank-Kamenetskii. Astron. Zh., 39: 247-55(1962). (In Russian).

The Rosseland mean opacity and radiative thermal conductivity of ionized hydrogen were calculated considering electron scattering and bremsstrahlung processes. The results are compared with Sommerfeld and Elvert approximations. An interpolation formula for the radiative thermal conductivity of completely ionized hydroger is given. (auth)

7440 RESEARCH ON PLASMA OF MORE RECENT AND GENERAL INTEREST. J. E. Allen, B. Brunelli, and R. Toschi (Comitato Nazionale Energia Nucleare, [Frascati, Italy]). Comit. Naz. Energia Nucl., Notiziario, 8: No. 4, 13p. (Apr. 1962). (RT/FI(62)36). (In Italian)

Uses of plasma in the field of applied physics and electrotechnics are illustrated. Techniques used in plasma laboratories are also described. (auth)

7441 INSTABILITY AND DAMPING IN A BEAM-PLASMA SYSTEM. Claude Étievant and Mario Perulli. Compt. Rend., 255: 855-7(July 30, 1962). (In French)

In a beam-plasma system a complete stability of the electrostatic waves was observed for Debye distances higher than a certain critical value ($\lambda_d \sim 2$ mm). This stability can be interpreted as a manifestation of the Landau effect. An analysis of the velocity distribution of the beam shows an enlargement in correlation with the appearance of electrostatic instabilities. For very high plasma densities, 10^8 electron/cm^3, the interaction is very important and leads in certain cases to a complete suppression of the peak of the velocity distribution of the beam. (tr-auth)

7442 EXPERIMENTAL STUDY ON PUTTING AN ELECTROCONDUCTIVE LIQUID, IN A RECTANGULAR TUBE, INTO TURBULENT REGIME IN THE PRESENCE OF A MAGNETIC FIELD. Étienne Crausse, René Causse and Yves Poirier (Faculté des Sciences, Alger, France). Comp. Rend., 255: 1334-6(Sept. 3, 1962). (In French)

An experimental study was made of putting an electroconductive liquid into turbulent regime in a rectangular tube in the presence of a uniform magnetic field normal to the flow. Curves were obtained for different values of the motive pressure and of the field. (tr-auth)

7443 ANALYSIS OF LUMINOUS PHENOMENA ACCOMPANYING THE EXPLOSION OF A THREAD-LIKE CHANNEL OF IONIZED GAS. Maurice Skowronek and François Cabannes (Laboratoire des Echanges Thermiques, Bellevue, France). Comp. Rend., 255: 1391-3(Sept. 10, 1962). (In French)

The explosion of a channel of preionized air was studied. A fine cylinder of highly ionized plasma was observed for almost 150 μsec. During current maxima, the entire space is illuminated well before the arrival of the shock wave, which is probably caused by a high emission of ultraviolet radiation on the axis. The shock wave and the plasma expansion have a perfectly cylindrical symmetry. (tr-auth)

7444 A POSSIBLE EXPLANATION OF THE NATURE OF STANDING STRIATIONS IN A HIGH-FREQUENCY DISCHARGE. L. Pekárek and V. Krejčí (Inst. of Physics, Czechoslovac Academy of Sciences, Prague). Czech. J. Phys., 12: 722-3(1962). (In English)

It is assumed that the electron concentration in some region of a h-f discharge is, by some mechanism, lowered below that in the surrounding plasma. This situation results in a decrease in the electric conductivity of the plasma, which in turn causes a rise in the local electron temperature. The increased temperature causes a rise in the ionization rate in this region, which effect tends to destroy the region of low electron concentration. The high temperature also, however, tends to bring about a diffusion of the electrons from the region of high temperature into the region of low temperature, and this diffusion tends to enhance the concentration deviation. It is noted that if the diffusion mechanism dominates the ionization mechanism, this mechanism may give rise to standing striations in the discharge plasma. (T.F.H.)

7445 THE EFFECT OF A TRANSVERSE MAGNETIC FIELD ON A TOROIDAL ELECTRIC DISCHARGE. L. A. Artsimovich and K. B. Kartashev. Doklady Akad. Nauk SSSR, 146: 1305-8(Oct. 21, 1962). (In Russian)

In investigating large pulse discharges in a toroidal chamber with a stabilized, longitudinal magnetic field on the large experimental apparatus "Tokamak," it was found that the double-humped, current discharge, curve with time can be explained by the radial motion of a plasma. The axial shift of a plasma towards the wall of a torus is designated as δ, and in the ideal case can be described by the following equation: $\delta = (b^2/2R)[\ln(b/a) + (1 - a^2/b^2)(8\pi\bar{\rho}/B_a^2 - \frac{1}{4})]$. Here a is the cross-sectional radius of the plasma; b is the cross-sectional radius of the torus; $\bar{\rho}$ is the average plasma pressure, and B_a is the magnetic field of the plasma current at the edge of the plasma. Limiting diaphragms were used to define the cross-sectional area of the plasma. Under actual conditions, external electrical sources result in the appearance of a small component of the magnetic field B_z which varies during the electrical discharge, and creates an additional radial force which changes the equilibrium displacement δ. The value of B_z can be determined experimentally, and is ordinarily about 0.2% of B_0. A plot of the displacement along the axis δ is qualitatively correlated with the changes in magnitude of the discharge current. First, the axis of the plasma loop is shifted towards the wall of the torus, and starts to react with the diaphragms placed in the chamber. The radius of the plasma loop decreases, and the plasma cools (the current falls). The plasma loop moves inward; the plasma heats up again, and the radius of the plasma loop increases (with a decrease in concentration of particles in the plasma loop). Conductors placed between the liner and external shell can be used to control the value of B_z, and to improve the heating of a plasma in a toroidal chamber. (TTT)

7446 TEMPERATURE DETERMINATION BY TRANSMISSION TIME MEASUREMENTS ON PLASMA RAYS. H. Schneider and H. U. Hostettler (Universitat, Freiburg i. B.). Helv. Phys. Acta, 35: 241-5(1962). (In German)

In a plasma without applied external magnetic field electromagnetic waves are excited and their phase velocity is measured for frequencies between $\omega = 10^6$ and 10^7 sec^{-1}. The experiment represents a determination of the plasma conductivity and further of the temperature, if a theoretical temperature dependance of the conductivity is assumed. The observed dispersion is in good agreement with theory. A maximum plasma temperature of 20,000°K was found, decaying roughly exponentially with a time constant of 180 μsec. (auth)

7447 MAGNETOACOUSTIC RESONANCE IN A CYLINDRICAL PLASMA. E. Cantieni and H. Schneider (Universität, Freiburg i. B.). Helv. Phys. Acta, 35: 245-50(1962). (In German)

Magnetoacoustical waves were produced in a cylindrical geometry, and observations were made which were in quantitative agreement with a theory proposed for partial ionization. A new diagnostic method is given which permits the determination of the ionization degree in a partially

ionized plasma and of the temperature in a completely ionized plasma. The measurements show that under the parameters required from theory, resonance is always present. Typical curves are shown. (J.S.R.)

7448 THERMONUCLEAR PLASMAS. Stirling A. Colgate and Harold P. Furth. Intern. Sci. Technol., No. 2, 34-41(Feb. 1962). (UCRL-6670-T)

To get power from nuclear fusion reactions a low pressure gas of heavy hydrogen needs to be heated to temperatures in excess of 100,000,000°K and held in place by magnetic forces for at least a tenth of a second or so. Reaching the required temperature seems not as difficult as containing the resultant plasma for a sufficient time. Plasma instabilities, however, permit it to escape from magnetic confinement. These instabilities fall into two classes, hydromagnetic instabilities and microinstabilities. The first class arises from the electrical and fluid properties of a plasma, without considering its detailed structure; the second class is caused by anisotropies in the distribution of the velocities of the particles in a plasma. Although no fusion device is completely free of such instabilities, considerable experience can be gained on how to control them. One guideline seems to be to keep the plasma pressure small compared with the pressure exerted on it by the confining magnetic field; another is to keep the particle-velocity distribution close to thermal equilibrium. Toy Top, an experimental fusion device of the mirror-machine type, which comes close to satisfying these criteria, can achieve ion temperatures close to the thermonuclear range, for only 0.1 millisec because of residual instabilities. (auth)

7449 A HOT PLASMA PRODUCED BY A LINEAR DISCHARGE DEVICE WITH A LARGE CAPACITY CONDENSER BANK. Hiroshi Enjoji, Kousuke Okamoto, Yukio Ishibe, Yuichi Sakamoto, Akio Furuichi, Kazuo Mori, and Kouzou Andou (Inst. of Physical and Chemical Research, Tokyo). Japan. J. Appl. Phys., 1: 282-94(Nov. 1962). (In English)

A linear discharge plasma is studied that is produced by means of an electrolytic condenser bank of large capacity (1.1×10^4 to 1.3×10^5 μf) and low working voltage (500 v). The discharge current is non-oscillatory. The maximum values of the discharge current, the duration of discharge, and the rate of increase of the discharge current are 100 ka, 4.5 msec, and 10^9 amp/sec, respectively. Observation by means of search coils and a magnetic probe reveals that the plasma is helical, and that the helix, by rotating and expanding, finally touches the inside wall of the tube. The effect of the axial magnetic field on the discharge current is studied. The electron density n_e and the electron temperature T_e as estimated by microwave measurement and spectroscopic observation are: n_e (microw.) $> 10^{12}$ electrons/cm^3; n_e (spectr.) 10^{15} electrons/cm^3; T_e (microw.) 40 ev; T_e (spectr.) 10-20 ev. (auth)

7450 THE WATER-BAG MODEL OF A SHEET ELECTRON BEAM. D. C. dePackh (Naval Research Lab., Washington, D. C.). J. Electron. Control (1), 13: 417-24(Nov. 1962). (In English)

A sheet electron beam in a fictitious focusing field (regarded as purely electric) in a frame moving with the electron is analyzed in terms of a model in which the phase-space density changes in discrete steps at certain contour lines in the phase plane. The equilibria and the eigenvalues for small perturbations in the case of a single contour are worked out. The advantage of this technique is that the only significant motions are those of the contour itself, the phase fluid inside being incompressible and homogeneous. (auth)

7451 ANALYSIS OF THE ELECTRON DISTRIBUTION FUNCTION IN A HIGH FREQUENCY DISCHARGE. PART I. P. Maroni, R. Jancel and T. Kahan (Institut Henri-Poincare, Paris). J. Phys. Radium, 23: 425-32(July 1962). (In French)

The electron distribution function, solution of the Boltzmann integro-differential equation, is studied in a Lorentzian plasma in the presence of a high-frequency electronic field, allowance being made for the fundamental processes of ionization, excitation, and diffusion. This analysis deals with the computation of the two first approximations of this distribution function. Several cases related to different hypotheses on the collision frequency and the excitation and ionization probabilities are examined. (auth)

7452 MICROWAVE RADIATION FROM PLASMAS. Shigeo Hagiwara (Tokyo Univ.). J. Phys. Soc. Japan, 17: 1890-6(Dec. 1962). (In English)

Observations were carried out in a microwave region in which the wavelength was comparable to or shorter than a dimension of the discharge tube. Incoherent (noise) radiation from plasmas that were semi-opaque or opaque was observed. Comparison between the electron temperature determined from microwave measurement and that from electrostatic probe measurement gave agreement. It was experimentally shown that the plasma oscillation in a hot cathode discharge tube gave rise to radiation. Obtainable power of this radiation was estimated about 0.1 μw. (auth)

7453 CONTROLLED THERMONUCLEAR FUSION EXPERIMENTS. H. Kever and K. Schindler (Kernforschungsanlage des Landes Nordrhein-Westfalen, Julich, Ger.). Kerntechnik, 4: 562-8(Dec. 1962). (In German)

A review is given on high temperature plasma experiments set up in Western Europe laboratories for obtaining thermonuclear reactions. Methods for heating and confining dense plasmas are the pinch-effect and the fast magnetic compression. In mirror- and stellarator-systems a plasma of lower pressure is contained during longer periods. Some other experiments are designed for the production and acceleration of hot plasmas. A survey of the most important diagnostic techniques is added. (auth)

7454 AMBIPOLAR DIFFUSION OF A PLASMA IN A WEAK MAGNETIC FIELD. R. W. Fredricks and F. Mastrup (Space Technology Labs., Inc., Redondo Beach, Calif.). Phys. Fluids, 6: 36-9(Jan. 1963).

A generalization of the phenomenological description of ambiopolar diffusion of a plasma is made to include the effects of a weak impressed magnetic field. The assumptions of congruence of the flow vectors (div Γ^+ = div Γ^-) for ions and electrons and of proportionality [n^- grad (n^+) = n^+ grad (n^-)] on the signed charge densities are utilized as in the existing theory of ambipolar diffusion; however, because of the rotational effects of the magnetic field, and additional assumption is made on the curls of Γ^s. This assumption is curl Γ^+ = curl Γ^-. The resulting diffusion is found to be a combination of electronic and ionic diffusion, and the components of the ambipolar diffusion tensor are calculated for a unidirectional magnetic field. (auth)

7455 CONDENSED PRESENTATION OF TRANSPORT COEFFICIENTS IN A FULLY IONIZED PLASMA. I. P. Shkarofsky (RCA Victor Research Labs., Montreal), Ira B. Bernstein, and B. B. Robinson. Phys. Fluids, 6: 40-7(Jan. 1963).

A presentation of transport coefficients in a fully ionized plasma in terms of effective collision, gyration, and oscillation frequencies is given. It has the virtue of reducing the task of presenting the data to the tabulation of certain dimensionless functions of restricted variation. Moreover

the quantities involved are directly related to the reciprocals of the coefficients usually considered, for instance to the resistivity rather than the conductivity. (auth)

7456 PREVALENT INSTABILITY OF NONTHERMAL PLASMAS. H. P. Furth (Univ. of California, Livermore). Phys. Fluids, 6: 48-57(Jan. 1963). (UCRL-6907)

In thermally anisotropic plasmas or sheet pinches, the zero-order counterstreaming or directed streaming of like particles gives rise to instability modes that correspond essentially to the formation of local first-order pinches within the plasma. The marginal stability criteria for all such modes can be interpreted in terms of Bennett's pinch condition. The range of examples discussed includes Weibel's thermally anisotropic hot-electron plasma instability in null field, which is generalized for hot ions and finite magnetic field, and which is applied to interpenetrating neutral plasma streams, to a spherical electrostatic plasma-containment scheme, and to the Astron thermonuclear experiment. The familiar "mirror instability" is shown to be another example of a "pinch"-type mode. Sheet pinches with or without longitudinal magnetic field are generally unstable against tearing into subsidiary linear pinches. (auth)

7457 PLASMA ELECTROMAGNETIC INSTABILITIES. R. N. Sudan (Cornell Univ., Ithaca, N. Y.). Phys. Fluids, 6: 57-61(Jan. 1963).

A gyrotropic plasma with $T_{||}/T_{\perp} \equiv \gamma < 1$, where $T_{\perp}$ and $T_{||}$ are the transverse and longitudinal temperatures, is shown to be unstable to a perturbation in the form of a transverse wave with a wave vector k such that $k^2 < k_0^2 = \{\omega_c^2\, 1-\gamma)^2 + \omega_p^2(1-\gamma)/\gamma\}/c^2$, ω_c and ω_p are the gyro and plasma frequencies. For $T_{||} > T_{\perp}$ such an instability arises only if $\omega_c^2/\omega_p^2 > 1/\gamma(\gamma-1)$ and then only for $k^2 < k_0^2$. However, in the latter case, the phase velocity of the instability exceeds c and the growth rate must be made to vanish because of relativistic considerations. No such instability arises for complete isotropy $T_{\perp} = T_{||}$. (auth)

7458 LOWERING OF THE IONIZATION ENERGY FOR A PLASMA IN THERMODYNAMICAL EQUILIBRIUM. G. Ecker and W. Kroell (Universität, Bonn). Phys. Fluids, 6: 62-9(Jan. 1963).

In a plasma the ionization energy is decreased due to the presence of the microfield. In the past several attempts have been made to calculate this effect. These calculations, which use statistical and thermodynamical procedures, give different results. They produce either a "polarization term" or a "lattice term" or both of them. Moreover there are quantitative discrepancies. The lowering of the ionization energy is here derived by a statistical method, which is physically conceivable. The results cover a wide density range below and above the so-called critical density. The new results are compared with the results of all earlier calculations and reveal the cause of their discrepancies. (auth)

7459 LIMITS OF COLLECTIVE DESCRIPTION AND THEIR CONSEQUENCES FOR LANDAU DAMPING. G. Ecker and J. Hoelling (Universität, Bonn). Phys. Fluids, 6: 70-5(Jan. 1963).

By application of the concept of collective description to a fully ionized gas, Vlasov's equation follows from Liouville's theorem. To what extent the statistical collective procedure describes correctly the behavior of the single system under consideration is studied. Therefore, a criterion for the validity of the collective approach is deduced by comparison of the Vlasov equation with the exact individual description. The result is exemplified by an application to Landau's theory of damping of plasma oscillations. (auth)

7460 COLLISIONAL DAMPING OF PLASMA OSCILLATIONS. G. G. Comisar (Aerospace Corp., Los Angeles, Calif.). Phys. Fluids, 6: 76-82(Jan. 1963).

The attenuation of electron oscillations in a fully ionized plasma with a small amount of Coulomb scattering is investigated by means of the Fokker-Planck equation. In the treatment, dynamical coefficients with the proper velocity dependence are utilized in contrast to previous work based upon simplified collisional models. The use of transform methods leads to a modified Landau dispersion integral from which follow the temporal damping decrement for ion-electron collisions: $\gamma_i = [\nu_{coll}/3(2\pi)^{1/2}][1 + 4\ (k\ r_D)^2]$; and the corresponding electron-electron decrement: $\gamma_e = [\nu_{coll}/3(\pi^{1/2})][1 + 3.85\ (k\ r_D)^2]$, where ν_{coll} is the electron collision frequency, k is the oscillation wavenumber, and r_D is the Debye correlation length. (auth)

7461 ANALYSIS OF THE TRANSITION REGION BETWEEN A UNIFORM PLASMA AND ITS CONFINING MAGNETIC FIELD. [PART] II. James Hurley (New York Univ., New York). Phys. Fluids, 6: 83-8(Jan. 1963).

The case of one-dimensional geometry for the transition region separating a uniform plasma from its confining magnetic field is considered. The magnetic-field profile within the boundary layer is determined by the current distribution, i.e., by the paths of the ions and electrons. The paths of these particles, on the other hand, are determined by the fields in which they move. An exact, self-consistent solution of Maxwell's equations and the equations of motion of the particles is obtained. A detailed analysis is made for a hydrogen plasma. These results are then compared with those of a plasma whose positive constituent is the proton and whose negative constituent has a mass which approaches zero and a speed which approaches infinity in such a way that the energy remains finite. The transition layer thickness for these two plasmas agree to one part in 10^6. It is shown that this latter case is equivalent to treating the electrons of the hydrogen plasma in the guiding-center approximation. (auth)

7462 RELATIVISTIC EFFECTS ON PLASMA OSCILLATIONS AND TWO-STREAM INSTABILITY. [PART] I. B. Buti (Univ. of Chicago and Yerkes Observatory, Williams Bay, Wis.). Phys. Fluids, 6: 89-99(Jan. 1963).

The general theory for high-temperature plasmas, in the presence of an external uniform magnetic field, is developed by means of a Laplace-transform technique. The dispersion relations for the longitudinal and the transverse oscillations for a relativistic Maxwellian distribution with mass motion as well as for a non-Maxwellian distribution in the absence of magnetic field are derived. The stability of two streams is investigated in detail both in the nonrelativistic and in the extreme relativistic limits. The longitudinal and the transverse modes are uncoupled only when the stream velocity and the wave velocity are parallel. (auth)

7463 RELATIVISTIC EFFECTS ON PLASMA OSCILLATIONS AND TWO-STREAM INSTABILITY. [PART] II. B. Buti (Univ. of Chicago and Yerkes Observatory, Williams Bay, Wis.). Phys. Fluids, 6: 100-7(Jan. 1963).

The dispersion relations and the problem of the stability of two streams, in the presence of an external magnetic field, are discussed by using the general theory developed in an earlier paper [B. Buti, Phys. Fluids, 5: 89(1962)]. For wave propagation parallel to the magnetic field, a relativistic Maxwellian distribution with mass motion is used;

and for wave propagation in a direction perpendicular to the magnetic field, an isotropic non-Maxwellian distribution is employed. In the latter case, gaps in the frequency spectrum occur. (auth)

7464 NONTHERMAL IMPURITY RADIATION FROM A SPHERICAL PLASMA. S. Cuperman, F. Engelmann, and J. Oxenius (EURATOM-CEA, Fontenay-aux-Roses, France). Phys. Fluids, 6: 108-15(Jan. 1963).

The steady-state energy loss of a homogeneous and isothermal spherical plasma due to de-excitation radiation of impurity ions, assumed to have two energy levels only, is investigated without making the assumption that this radiation is thermal. A method developed by R. N. Thomas is adopted which consists in solving simultaneously the equation of radiative transfer and the equations for the rate of change of the occupation numbers of the energy levels. Analytical methods for calculating the source function obtained in this way are indicated. (auth)

7465 PARTICLE BEHAVIOR IN A STATIC, ASYMMETRIC, MAGNETIC MIRROR GEOMETRY. G. Gibson, W. C. Jordan, and E. J. Lauer (Univ. of California, Livermore). Phys. Fluids, 6: 116-24(Jan. 1963). (UCRL-6856)

The motion of a charged particle in an asymmetric mirror geometry has been studied. The asymmetric geometry for these studies is constructed by giving equal but opposite tilts to the two identical, coaxial coils of a symmetric geometry in which the coils are spaced about one coil mean diameter apart. (This is equivalent to one section of a "bumpy torus.") A model for describing a particle's motion in this geometry is presented. It is based on the guiding-center drift surfaces determined theoretically from the longitudinal and transverse adiabatic invariants and the invariance of the magnitude of the momentum. The results of the experimental investigations are successfully interpreted in terms of the model. (auth)

7466 PARTICLE BEHAVIOR IN STATIC, AXIALLY SYMMETRIC, MAGNETIC MIRROR AND CUSP GEOMETRIES. Gordon Gibson, Willard C. Jordan, and Eugene J. Lauer (Univ. of California, Livermore). Phys. Fluids, 6: 124-41(Jan. 1963). (UCRL-6771)

A mean containment time τ of many seconds has been observed for a significant fraction of the energetic ($\leq$2.2-Mev) positrons emitted from Ne^{19} isotropically and uniformly in a mirror geometry with mirror ratio R in the range 1.1 to 3.7. Long-time containment has been observed for particles that escape through a mirror at radial distances for which the particle orbits do not encircle the axis, as well as for those that escape on or near the axis. The depencence of τ on the Z of the scattering gas, the gas pressure, the positron energy, the coil current, and the diameter and separation of the coils has been investigated. Most of the data were obtained with the two mirror coils separated one coil mean diameter. For sufficiently small values of λ (the ratio of the maximum orbit diameter on axis to the coil mean diameter), τ is independent of λ and its dependence upon the above parameters agrees with the predictions of scattering theory. Also, the fraction of particles trapped as a function of the mirror ratio agrees with calculations based on the loss cone concept. These results demonstrate that the particles "behave adiabatically" if λ is less than about $\frac{1}{10}$. For larger values of λ the observed τ's are shorter. Results obtained with probes are in agreement with the prediction that the interactions of particle drift surfaces with the plane midway between the mirror coils are concentric circles centered on the axis. In the cusped field resulting from opposite currents in two coils separated by one coil mean radius, containment times of several seconds have been observed at radial distances where the field is of sufficient strength that "adiabatic behavior" is expected. Near the axis, however, no long-time (>0.5-sec) containment has been observed. (auth)

7467 THERMAL ELECTRIFICATION AND REMOVAL OF ELECTRONS BY SOLID PARTICLES IN A GAS. S. L. Soo (Univ. of Illinois, Urbana). Phys. Fluids, 6: 146-7(Jan. 1963).

Dust particles of a refractory material may provide a method for the removal of free electrons in a gas plasma, provided that the thermionic emission from the dust particles is negligible. A study was made of thermionic emission from solid particles in thermodynamic equilibrium with a gas. (L.T.W.)

7468 MEASUREMENTS OF ELECTRONIC THERMAL CONDUCTIVITY IN MAGNETOPLASMAS. F. Rostas, Ashok K. Bhattacharya, and J. H. Cahn (Univ. of Illinois, Urbana). Phys. Rev., 129: 495-505(Jan. 15, 1963).

Electronic thermal conduction in a magnetoplasma with electron number densities of the order of 10^{11} to 10^{12} cm^{-3}, where Coulomb interactions predominate, has been studied experimentally in neon discharges at a pressure of the order of 5 mm Hg, and magnetic fields up to 1200 Oe. The temperature distribution resulting from a very localized heating of the electron gas by an electromagnetic wave of frequency 7500 Mc/sec has been measured in a plane perpendicular to the magnetic field and at variable distances from the heated volume. The experimental results are compared with the predictions of Landshoff. (auth)

7469 MICROWAVE EMISSION FROM NON-MAXWELLIAN PLASMAS. H. Fields, G. Bekefi, and Sanborn C. Brown (Massachusetts Inst. of Tech., Cambridge). Phys. Rev., 129: 506-15(Jan. 15, 1963).

Microwave measurements of the radiation from a weakly ionized low-energy plasma immersed in a magnetic field show significant departures from the Kirchhoff-Planck law. The departures can be explained by taking account of the non-Maxwellian distribution of the radiating electrons. By comparing the measured and calculated radiation temperatures we estimate the distribution of electron velocities and their mean energy. (auth)

7470 OBSERVATIONS OF IONIC SOUND WAVES IN PLASMAS: THEIR PROPERTIES AND APPLICATIONS. I. Alexeff and R. V. Neidigh (Oak Ridge National Lab., Tenn.). Phys. Rev., 129: 516-27(Jan. 15, 1963).

Extensive experimental studies of the ionic sound waves predicted by Tonks and Langmuir are discussed. Self-excited oscillations have been observed both in magnetically supported plasma columns and in spherical discharge tubes. The fundamental frequency and the overtones of each system agree with those predicted by the ionic-sound-wave formula in terms of the electron temperature, the ion mass, and the dimensions of the system. A simple equation is used to predict when damping by the neutral gas prevents a given mode of plasma oscillation from being observed. The thermal electron pressure, required for the existence of an ionic sound wave, has been measured mechanically. Resonance effects have been observed between the ionic-sound and the ion cyclotron frequency in the magnetically supported plasma column. Practical applications of ionic sound waves are as follows: The electron temperature of a plasma was found by measuring the frequency of a standing ion-wave mode. The neutral gas density was estimated by observing the gas damping of various standing ion-wave modes. (auth)

7471 ELECTROSTATIC TURBULENCE IN A REFLEX DISCHARGE. Francis F. Chen and Alfred W. Cooper

(Princeton Univ., N. J.). Phys. Rev. Letters, 9: 333-5 (Oct. 15, 1962). (MATT-140)

A continuous spectrum of low-frequency oscillations is found in many types of gas discharge maintained by a flow of current. An experiment using correlation techniques to measure the longitudinal wavelength of each frequency component of the fluctuations is performed to see whether the continuum of oscillations at high magnetic fields can be decomposed into ion waves with a distribution of frequencies. The data indicate the longitudinal wavelength of the oscillations is much to long to be ion waves. The wave velocity calculated from the measured quarter-wavelengths is of the order of 2×10^7 cm/sec, which is much larger than the acoustic velocity ($\sim 10^6$) and much smaller than the Alfvén velocity (10^9). The cause of the oscillations has not been determined. (H.D.R.)

7472 ENERGY EQUIPARTITION IN AN ELECTROMAGNETIC WAVE PROPAGATING THROUGH A FULLY IONIZED GAS IN A UNIFORM MAGNETIC FIELD. J. P. Klozenberg (Radio Research Station, Slough, Eng.). Planetary Space Sci., 9: 793-9(Nov. 1962). (In English)

The ratio of gas kinetic energy to total electromagnetic field energy of a wave is evaluated for propagation along and perpendicular to the resident magnetic field. The frequencies are found at which equipartition of energy occurs. (auth)

7473 A THEORY OF THE TURBULENT ELECTRIC FIELD FLUCTUATIONS IN ELECTRON PLASMAS. [PART] I. Takao Tsuda (Kyoto Univ.). Prog. Theoret. Phys. (Kyoto), 28: 489-507(Sept. 1962).

The method of redundant variables for many-body problems is fully exploited in order to analyze, by means of collective coordinates, the macroscopic turbulent electric field fluctuations in electron plasmas. The theory is based on a non-perturbational technique, which utilizes the statistical stability of the Gaussian distribution of random fluctuations. In this spirit, an attempt is made to clarify the stationary phase distribution of large-amplitude long-wavelength longitudinal electric field fluctuations, neglecting the effects due to thermal motions of individual electrons; but the most essential feature of nonlinear interactions between distinct modes is entirely retained. (auth)

7474 RADIAL DENSITY DISTRIBUTION IN THE PLASMA COLUMN IN THE REGION OF THE CRITICAL MAGNETIC FIELD. Masatomo Sato (Nihon Univ., Tokyo). Prog. Theoret. Phys. (Kyoto), 28: 562-4(Sept. 1962).

Modification of the averaged density distribution of plasma by helical distortion was investigated by Ichikawa and Sasakura (Prog. Theor. Phys., to be published.) and they concluded that the enhanced particle loss is due to the increase of the density gradient. They obtained the apparently unphysical result that the density is negative near the boundary surface due to the neglect of the boundary sheath effect. It is shown that this is not the case and by taking into account the boundary condition and the modification of the rate of ionization, a resolvable result for the density distribution is obtained. (W.D.M.)

7475 ANOMALOUS DIFFUSION IN THE POSITIVE COLUMN IN THE LONGITUDINAL MAGNETIC FIELD. K. H. Woehler (Max-Planck-Institut für Physik und Astrophysik, Munich and Institut für Plasmaphysik, Munich). Z. Naturforsch., 17a: 937-62(Nov. 1962). (In German)

The positive column of a low pressure stationary gas discharge in a longitudinal magnetic field was investigated. Above a critical magnetic field the charged particle losses of the discharge increase rapidly in contradiction to the diffusion theory of the positive column. This effect is known as Lehnert-effect. Different theories and hypotheses were investigated and compared with experiments to explain this phenomenon. It is shown that all experiments are most compatible with a theory of Kadomtsev which states the anomalous behavior of the positive column to be a turbulence like instability. (auth)

7476 INVESTIGATION OF THE PLASMA BOUNDARY LAYER IN A LOW-PRESSURE DISCHARGE. Werner Ott (Institut für Plasmaphysik G.m.b.H., Munich). Z. Naturforsch., 17a: 962-7(Nov. 1962). (In German)

The electrical field in the space charge sheath between a Hg low-pressure plasma and an insulated plane wall was measured with an electron beam probe. Near the wall, the field strength was observed to increase linearly. Linear extrapolation to zero field strength was used to define the thickness of the sheath which turned out to be 3 to 5 times the Debye length. On the other hand, the potential, the electrical field strength, and the space charge density in the sheath were calculated (using Bohm's criterion). Also theoretically, an approximately linear increase of field strength was found. A linear extrapolation of the theoretical values gave a boundary layer thickness about 6.7 to 6.9 times the Debye length, if the wall was at floating potential. Some differences were found between the experimental and the theoretical values of the wall potential and the space charge density in the sheath. (auth)

7477 MEASUREMENT OF THE RADIAL ELECTRON DENSITY AND MAGNETIC FIELD DISTRIBUTION IN A THETA PINCH AND COMPARISON WITH NUMERICAL CALCULATIONS. E. Fuenfer, K. Hain, H. Herold, P. Igenbergs, and F. P. Kuepper (Institut für Plasmaphysik G.m.b.H., Munich). Z. Naturforsch., 17a: 967-76(Nov. 1962). (In German)

In a Θ-pinch the electron density as function of space and time was measured by a Mach-Zehnder interferometer. Also the magnetic fields were determined with help of magnetic probes. These experimental results were compared with the hydromagnetic theory. The agreement between these two held for several compressions in the case of a captured parallel field, however, only for one compression for the antiparallel field. The disagreement for later times for the parallel field case can be explained by end losses and incomplete ionization which is not taken into account in the theory. In the antiparallel field case, however, the disagreement cannot be explained by generalizing the hydromagnetic theory. It seems almost sure that microinstabilities will cause the fast mixing of magnetic fields found experimentally. (auth)

7478 THE ENERGY YIELD OF ELECTRONS AND THE HARD X RAYS PRODUCED BY THEM IN THETA PINCH DISCHARGES BEFORE THE IGNITION. R. Chodura and M. Keilhacker (Institut für Plasmaphysik G.m.b.H., Munich). Z. Naturforsch., 17a: 977-89(Nov. 1962). (In German)

Measurements were made of hard x rays produced in theta pinch discharges before breakdown of the gas which often lasts for several half-cycles of the magnetic field. In order to explain the time-dependent intensity and energy of the x rays, two possible spatial distributions of the electric field in a theta pinch-coil are discussed and the gain of energy of charged particles is calculated. The calculation shows that the adiabatic invariant $\mu = m^2v^2/(2m_0B)$ which gives the gain of energy as a function of the magnetic field B is proportional to $(|\dot{\omega}_g|^{5/2}t_0)^{-3}$ where $\dot{\omega}_g$ is the time-derivative of the gyrofrequency which is assumed

to be constant and t_0 is the time between zero magnetic field and the start of the particle. Therefore the hard x rays can be produced only by electrons which were existing in a small time interval around zero magnetic field of the order $|\dot{\omega}_g|^{-\frac{1}{2}}$. Because of the dependence of μ on the initial position of the particle the electrons have an energy distribution which is calculated under the assumption that all electrons are uniformly distributed initially over the cross section of the coil. From the measured time dependence of x-ray intensity the spatial distribution of the electric field in half-cycles before breakdown can be inferred. The ratio of the x-ray intensities with and without absorbers was measured for different values of the time-dependent magnetic field and also for different steady bias magnetic fields by which the starting conditions (t_0) of the particles are altered. These ratios are in good agreement with corresponding theoretical values which are derived from the calculated energy distribution of the electrons. The experimental results show that in half-cycles before breakdown there exist different spatial distributions of the electric field depending on the rising density of charged particles. (auth)

7479 AN OPTICAL INVESTIGATION OF MAGNETIC CONSTRICTION OF AN ELECTRON-HOLE PLASMA IN InSb. B. D. Osipov and A. N. Khvoshchev (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1179-83(Oct. 1962). (In Russian)

A study is made of alterations in the transversal distribution of intensity of recombination luminescence of an electron-hole plasma in the case of a cascade breakdown in single crystals of indium antimonide under the action of a longitudinal magnetic field. Direct proof is obtained of the existance of magnetic constriction (pinch effect) in a cascade-type breakdown. The temperature of the electron-hole plasma is determined from the radiation spectrum. The density of nonequilibrium electron-hole pairs is evaluated. (auth)

7480 AN INVESTIGATION OF VOLUME RECOMBINATION IN A HELIUM PLASMA IN A MAGNETIC FIELD. Yu. M. Aleskovskii and V. L. Granovskii (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1253-61(Oct. 1962). (In Russian)

An investigation was made, by probe and spectroscopic methods, of the deionization of a helium plasma in a homogeneous longitudinal magnetic field. By computation of the number of electrons captured on various levels in He atoms, it is shown that when $H > 1$ kOe, $n_e \geq 2 \times 10^{11}$ cm^{-3} and $p < 0.1$ mm Hg, charged particles disappear mainly due to volume recombination in triple collisions: $He^+ + 2e \rightarrow He + e$. The coefficient of recombination and its dependence on the electron temperature are determined. (auth)

7481 ON RATES OF TEMPERATURE EQUALIZATION OF CHARGED PARTICLES IN A PLASMA. R. R. Ramazashvili, A. A. Rukhadze, and V. P. Silin (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1323-30(Oct. 1962). (In Russian)

Problems are considered of the relaxation of temperature both in a gas of charged particles of a single kind and between the gases of particles of different kinds in a plasma with account taken of particle interaction with plasma waves. It is shown that the relaxation times of temperature in a strongly nonisothermal plasma may be considerably less than the relaxation times obtained without account taken of the interaction of particles and waves. (auth)

7482 ON THE EFFECT OF INTERNAL THERMAL MOTION ON THE POLARIZABILITY OF PLASMOIDS. V. B. Gildenburg (Gor'kii State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1394-6(Oct. 1962). (In Russian)

A study is made of the resonance properties of restricted plasma entities whose properties are due to the oscillatory nature of the internal thermal motion of electrons. As an illustration, the interaction of an alternating field is considered with a plasma localized in a one-dimensional rectangular potential well. (auth)

7483 ON THE THEORY OF TRANSFORMATION AND SCATTERING OF WAVES ON FLUCTUATIONS IN A PLASMA. F. G. Bass and A. Ya. Blank (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1479-88(Oct. 1962). (In Russian)

In the scattering of waves on fluctuations in a plasma, a transformation of one type of normal waves into another type is possible. The intensities of electromagnetic radiation and of the yield of longitudinal waves at the expense of transformation in a nonisothermal plasma are found. The spectral correlational functions of various quantities characterizing the fluctuations are determined. (auth)

7484 ENERGY-LEVEL SHIFTS AND THE EQUATION OF STATE OF A PLASMA. L. P. Kudrin and Yu. A. Tarasov. Zh. Eksperim. i Teor. Fiz., 43: 1504-16(Oct. 1962). (In Russian)

By means of the two-particle Green's function, a study is made of the level shifts of one-electron atoms in a plasma and of the equation of state of a Debye plasma. It is shown that low-energy states experience a shift proportional to the root of the density and to the ratio kT/E_n for the case when this ratio is small. The shift of the ground state of particles of charge $z - 1$ leads (in thermodynamic functions) to a correction that exceeds earlier obtained corrections to the Debye term if the densities of such particles are comparable with the electron density in the plasma. (auth)

7485 THE CAPTURE AND CONTAINMENT OF TURBULENT HEATED PLASMA IN MAGNETIC TRAP. M. V. Babykin, P. P. Gavrin, E. K. Zavoiskii, L. I. Rudakov, and V. A. Skoryupin. Zh. Eksperim. i Teor. Fiz., 43: 1547-9 (Oct. 1962). (In Russian)

Fast electron plasma heating ($\sim 10^{-7}$ sec to 1 kev) was previously described as a turbulent heating method. The turbulent heating method was used in developing hot electron plasma contained in a trap with magnetic ends. The distance between the ends was 60 cm, the magnetic field varied from 0 to 1000 Gauss, and the end winding ratio was 5. The confinement time was determined by plasma concentration and by variations of the (II) 4686Å line. The turbulent heating efficiency drops with increased $(H_0^2 + H_\sim^2)/H_\sim^2$ ratio. The experiment indicated a higher than theoretically predicted plasma stability. The containment time is close to the escape time due to Coulomb interactions. The results confirmed the efficiency of turbulent heating to high temperatures. (R.V.J.)

7486 INVESTIGATION OF THE EFFECT OF AN EXTERNAL MAGNETIC FIELD ON THE LIGHT CHARACTERISTICS OF A PULSED DISCHARGE IN ARGON. S. I. Andreyev, M. P. Vanyukov, and A. T. Starovoitov (Vavilov State Inst. of Optics, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1616-18(Nov. 1962). (In Russian)

Results of measurement of the brightness of light flashes from a pulsed discharge in argon are presented for argon in a quasistationary magnetic field H = 150,000 Oe and for a zero field; the gas pressure was varied between 20 and 740 mm Hg. At pressures of 20 and 100 mm Hg the brightness of the discharge flashes was found to increase at

150,000 Oe. At the initial stage of development of the discharge in a field H = 150,000 Oe the rate of expansion of the discharge column is lower than that in the absence of an external magnetic field. (auth)

7487 "ANOMALOUS" DIFFUSION OF A RAREFIED PLASMA WITH A CURRENT IN A MAGNETIC FIELD. B. B. Kadomisev. Zh. Eksperim. i Teor. Fiz., 43: 1688-96(Nov. 1962). (In Russian)

It is shown that in the presence of a longitudinal field a rarefied plasma in a strong magnetic field is unstable with respect to waves of the drift type. This instability is similar to the current-convection instability of a plasma with finite conductivity, the only difference being that the collisions are replaced by Landau damping. Turbulent convection appearing as a result of such instability leads to anomalous diffusion of the plasma with a diffusion coefficient of the order of the Bohm coefficient. (auth)

7488 ON THE EFFECT OF RADIATION PROCESSES ON TRANSPORT PHENOMENA IN A PLASMA IN A STRONG MAGNETIC FIELD. A. I. Akhiezer, V. G. Baryakhtar, and S. V. Peletminskii (Khar'kov State Univ.). Zh. Eksperim, i Teor. Fiz., 43: 1743-9(Nov. 1962). (In Russian)

It is shown that the processes of radiation and absorption of electromagnetic waves by the electrons of a plasma in a strong magnetic field can appreciably influence not only the relaxation of electrons but also transport phenomena in the plasma. For this to occur in stationary fields it is necessary that there exist, in addition to radiation collisions, an additional mechanism capable of altering the photon distribution. In the case of a plasma with trapped radiation, this mechanism is the reflection of electromagnetic waves of frequency $\sim\omega_H = eH/mc$ (where m is the electron mass, H is the magnetic field) from mirrors confining the plasma. If the transverse dimensions of the cylindrical mirror (with axis parallel to H) is considerably less than the free path length of photons with frequency $\sim\omega_H$, the transverse conductivity of the plasma (like the transverse thermal conduction), which is due to radiation processes, is independent of the dimensions of the mirror and is determined by the effective time between radiation collisions of the electrons: $\tau_{eff} = \tau_e^{(r)}\, mc^2/T$ where $\tau_e^{(r)}$ is the time of radiation relaxation of the electrons, and T is the temperature. When, $\tau_{eff} \ll \tau_e^{(s)}$ where $\tau_e^{(s)}$ is the mean time of Coulomb relaxation, the transverse conductivity of the plasma will be determined not by Coulomb collisions but by radiation collisions. The effects are compared at density $n \sim 10^{14}$ cm^{-3}, $H \sim 5 \times 10^7$ G, $T \sim 3 \times 10^{-3}$ mc^2. In alternating fields, radiation processes can affect transport phenomena in the absence of mirrors as well. (auth)

7489 ON RELAXATION OF ELECTRON AND ION TEMPERATURES OF FULLY IONIZED PLASMA IN A STRONG MAGNETIC FIELD. V. P. Silin (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1813-20(Nov. 1962). (In Russian)

Under conditions when the Larmor radii of plasma particles do not exceed the screening radius of the Coulomb field, the effect of a magnetic field on particle-collision events becomes significant. Under these conditions, the relaxation time of electron and ion temperatures is dependent upon the magnetic field. The appropriate values of relaxation time are determined both in a broad interval of relationships between electron and ion temperatures and in a broad interval of magnetic-field values. (auth).

7490 SOME COLLECTIVE PROPERTIES OF PLASMAS. J. E. Drummond (Boeing Scientific Research Labs., Seattle). Preprint 2612-62. New York, American Rocket Society, 1962. 12p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

Causes of collective motions in plasma (electric, magnetic, and collisional correlations and the exclusion principle) are reviewed, and mechanisms that tend to destroy collective motions are outlined. The screw instability is given particular attention in both electric-arc and semiconductor plasmas. The pinch effect in semiconductors is discussed. Magnetohydrodynamic and non-magnetohydrodynamic collective characteristics of plasma are examined. (T.F.H.)

7491 NON-LINEAR ELECTRICAL CONDUCTIVITY OF PLASMA FOR MAGNETOHYDRODYNAMIC POWER GENERATION. H. T. Nagamatsu, R. E. Sheer, Jr., and J. A. Weil (General Electric Research Lab., Schenectady, N. Y.). Preprint 2632-62. New York, American Rocket Society, 1962. 8p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

The interaction of high-velocity air plasma with a transverse magnetic field is investigated in a hypersonic shock tube. Shock Mach numbers vary from 15 to 31 and the corresponding equilibrium temperature range is 5500 to 10,000°K. At high Mach numbers the induced electromotive force across the probes, for open circuit conditions, agrees with theoretical prediction. For the plasma produced by a Mach-30 shock wave, the voltage across the electrodes with different external loads decreases nonlinearly with increasing current flow. The plasma resistance across the electrodes decreases drastically at high current flows. With two copper electrodes at room temperature, area of 3.94 cm^2, it is possible to extract 447 amp from the plasma. The electrical conductivity increases with the current flow, and is found to be greater than the theoretical value. With an average magnetic field strength of 6500 gauss, a power as high as 155 kw is extracted from the moving air plasma. Because of the nonlinear increase in the conductivity, the extractable power from the plasma is much greater than the theoretical prediction. (auth)

7492 PLASMA TURBULENCE. Robert Betchov (Aerospace Corp., El Segundo, Calif.) and Leslie S. G. Kovasznay. Preprint 2613-62. New York, American Rocket Society, 1962. 7p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

Plasma turbulence and magnetohydrodynamic turbulence are reviewed. The areas of application are outlined, and the lack of valid nonlinear fundamental theory is emphasized. A simplified theory of incompressible MHD turbulence is described. Experimental results in a pinch device are also presented. (auth)

7493 AN INSTRUMENT TO MEASURE THE ELECTRICAL CONDUCTIVITY OF ARC PLASMA JET. A. E. Fuhs (Aerospace Corp., El Segundo, Calif.). Preprint 2635-62. New York, American Rocket Society, 1962. 7p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

A transducer is developed that measures the product (σu) of electrical conductivity (σ) and velocity (u) of conducting gases flowing along its axis. The instrument is calibrated by moving aluminum or graphite rods through the transducer. By using thin-wall stainless steel tubing, the influence function for the transducer is also obtained. Tests are run on two different arc plasma jet facilities. Values of σu range from 0.02 to 9 megamhos per second. (auth)

7494 INSTABILITIES IN A CO-AXIAL PLASMA GUN. T. J. Gooding, B. R. Hayworth, and R. H. Lovberg (General Dynamics/Astronautics, San Diego, Calif.). Preprint 2665-62. New York, American Rocket Society, 1962. 8p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

Configuration instabilities are observed in a gas-triggered coaxial plasma gun. Probe measurements of the azimuthal and axial components of the magnetic field indicate that the current distribution is initially azimuthally symmetric and collapses into a spoke at a time close to current maximum. Optical data taken with a Kerr cell camera confirm this observation. The instability is found to depend on the gas distribution in the gun at the instant of firing. (auth)

7495 DESTRUCTIVE EFFECTS OF PLASMAS GENERATED BY EXPLODING WIRES. Robert C. Good, Jr. (General Electric Co., Philadelphia). Preprint 2712-62. New York, American Rocket Society, 1962. 24p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

A capacitor bank is discharged through a tungsten wire in an evacuated chamber. The wire material is heated to about 10,000°K in the first microsecond, and the wire expands by a factor of ten. A plasma forms with an ion-pair density of about 10^{17} ions/cc. Nearby glass walls are heated to a condition in which microcracks form on the front surface. Photomicrographs of the surface show that the number of cracks increases as the stored energy is increased. Four main processes are postulated for energy transfer to the glass surface, namely: the hot plasma radiates electromagnetic waves; shock waves form, whose strength and propagation characteristics depend upon the surrounding media; the hot plasma expands to contact the glass surface; wire particles impact on the surface, creating crater-like pock marks. These processes are separated and the effects reported. Shock-wave effects are circumvented by exploding the wire at pressures of 10^{-5} mm Hg. Excessive sample surface damage occurs when the sample is placed near enough to the wire to allow plasma contact and surface crazing. High-speed debris from the wire causes extensive cratering of the surface. Photomicrographs of surfaces exposed to various energy flux densities show patterns of cracks with interspersed craters. By adding thin protective layers, the cracking is alleviated. Soft layers prevent cracking, whereas brittle layers replace the glass as the cracked substance. Boti types thus form protective layers. (auth)

Shielding

7496 (AEEW-M-261) RASH D—A MERCURY PROGRAMME FOR NEUTRON SHIELDING CALCULATIONS. D. E. Bendall (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Aug. 1962. 26p.

An improved version of an earlier neutron shielding program (RASH B) is described. The new program is also written in Mercury Autocode and solves a set of multi-group diffusion equations in one dimension. It differs from RASH B in that distributed source terms may be introduced into all the groups if required. Some other improvements are also included. (auth)

7497 / (DRCL-364) USE OF MODELS FOR GAMMA SHIELDING STUDIES. C. E. Clifford (Canada. Defence Research Chemical Labs., Ottawa). Feb. 1962. 22p. (AD-274301)

The use of models for shielding studies of buildings exposed to gamma radiation was evaluated by comparing the dose distributions produced in a blockhouse with movable inside walls exposed to 0.66 Mev gamma radiation with corresponding distributions in an iron 1 to 10 scale model. The effects of air and ground scaling on the readings in the model were also investigated. Iron appeared to be a suitable model material for simple closed buildings but for more complex structures it appeared that the use of iron models would progressively overestimate the gamma shielding protection as the complexity increased. (auth)

7498 (USNRDL-TR-594) AN IMPROVED ZINC BROMIDE SHIELDING WINDOW. W. B. Lane and M. J. Nuckolls (Naval Radiological Defense Lab., San Francisco). Oct. 2, 1962. 8p.

An improved zinc bromide-filled shielding window for hot cell use was designed, constructed, and performance-tested. Bare steel surfaces under an argon atmosphere satisfactorily contained zinc bromide solution. No corrosion or deterioration of optical properties appear in a window which was installed in May 1961. This system is an improvement over the previously used painted surfaces in an air atmosphere. (auth)

7499 RADIATION PROTECTION BY SHIELDING. P. F. Sauermann (Kernforschungsanlage Jülich, Ger.). Kerntechnik, 4: 481-4(Nov. 1962). (In German)

This is an elementary introduction into the methods of shielding gamma-rays and neutrons, informing engineers not specialized in this field on the principles of radiation protection by means of shielding. (auth)

7500 ON THE FEASIBILITY OF PRESTRESSED CYLINDRICAL CONCRETE SHIELDS FOR REACTOR PRESSURE-VESSELS. J. Seetzen and K. Sayar (Deutsches Elektronen-Synchrotron, Hamburg). Kerntechnik, 4: 485-91 (Nov. 1962). (In German)

Since prestressed concrete pressure-vessels of the type of the Marcoule G2 and G3 reactors apparently have not been used again, one might ask whether constructions of this type are practicable. The equations for calculating stresses due to heat production by absorption of gamma-rays and neutrons, due to the temperature difference between inner and outer shield surface and due to inner pressure and prestressing are given for the special shape of a cylindrical shield. By means of three examples calculated for the same reactor, the properties and limitations of such a construction are demonstrated. Under certain conditions it offers economical advantages. (auth)

7501 ON THE DETERMINATION OF GAMMA-RAY ATTENUATION FACTORS OF SHIELDING MATERIALS BY MEANS OF DIFFERENTIAL BUILD-UP-MEASURING. W. Futtermenger, H. Glubrecht, E. G. Niemann, and H. Schultz (Technische Hochschule, Hanover). Kerntechnik, 4: 504-8(Nov. 1962). (In German)

A method for measuring gamma-ray attenuation factors of shielding materials is described in which only small samples of material are needed. This method makes use of a narrow beam. The scattered radiation is measured by means of a scintillation crystal in dependence of the distance aside from the primary beam immediately behind the shield. The first result is that the scattered radiation will decrease after a simple function and that it can be integrated over the whole surroundings of the primary beam. Therefore the method allows the measurement of attenuation coefficients and build-up-factors for the stated gamma-

spectrum. The question of the detector influence is especially discussed. (auth)

7502 BIOLOGIC SHIELDING AGAINST GAMMA-RAYS FROM FISSION-PRODUCTS. W. Hebel (Lurgi Gesellschaft für Chemotechnik m.b.H., Frankfurt am Main). Kerntechnik, 4: 509-10(Nov. 1962). (In German)

An effective attenuation-coefficient is determined in order to calculate the biologic shielding against gamma-rays of an original fission product mixture. Its demonstration by diagrams is given as a function of the irradiation time of the uranium, of the cooling time after irradiation, of the wall thickness, and of the shielding material. (auth)

7503 SHIELDING OF RADIATIONS FROM REACTOR-BEAM-TUBES. S. Orecher and M. Oberhofer (Technische Hochschule, Munich). Kerntechnik, 4: 516-17(Nov. 1962). (In German)

Reactors are sources of intensive radiations which because of several reasons must be shielded. This article deals with the requirements to radiation-shieldings at beam-tubes, possible shielding materials, and some ideas for shielding design. (auth)

7504 RADIATION PROTECTION DOORS OF STEEL. H. Witte (Donges Stahlbau G.m.b.H., Darmstadt, Ger.). Kerntechnik, 4: 517-18(Nov. 1962). (In German)

Production instructions are given for radiation protection doors made of massive steel plates. Door hinges, motors, and safety devices are described. (auth)

Theoretical Physics

7505 ON THE ASYMPTOTIC BEHAVIOR OF THE VERTEX PART IN PSEUDOSCALAR MESON THEORY. G. Domokos. Acta Phys. Acad. Sci. Hung., 14: 341-4 (1962). (In Hungarian)

The asymptotic behavior of the vertex part is investigated under the assumption that $Z_2 < \infty$ $Z_3 < \infty$. The mesic form factor of the nucleon behaves as $(\log q^2)^{-\frac{1}{4}}$ for $q_2 \to \infty$. (auth)

7506 A REDUCTION FORMALISM FOR POTENTIAL SCATTERING. Ronald M. Rockmore (Brandeis Univ., Waltham, Mass.). Ann. Phys. (N. Y.), 20: 375-82(Dec. 1962).

It is shown that an asymptotic condition from potential scattering theory, together with a reduction formalism analogous to that introduced in quantum field theory, is sufficient to yield the fundamental relations of potential scattering theory. (auth)

7507 ON THE VARIATIONAL METHOD FOR NON-RELATIVISTIC SCATTERING. I. DIFFERENTIAL FORM. F. B. Malik (Princeton Univ., N. J.; Fordham Univ., New York; and Pakistan Atomic Energy Commission, Karachi). Ann. Phys. (N. Y.), 20: 464-78(Dec. 1962).

Hulthén's (Arkiv f. Mat. Astr. och Fys. 35: No. 25 (1948)) and Kohn's (Phys. Rev., 74: 1763(1948)) sets of equations for the functional of Hulthén are not enough to satisfy the Euler equation of the variational problem (even in case of infinite parameters), which is a necessary condition of the calculus of variation, because the phase shift found in either way usually fails to satisfy the identity obtained from the asymptotic behavior of the wave functions. Since the free boundary condition contains in itself the unknown phase shift, a self-consistent procedure is involved. A set of variational equations is suggested where a prescription is given to replace the self-consistency. The prescription ensures that the Schrödinger equation for the scattering comes out as the Euler equation of the variational problem. In this case Hulthén's and Kohn's methods become equivalent. Furthermore, this variational prescription automatically excludes choices of trial wave functions that give rise to variational parameters that are discontinuous functions of energy. The importance of the sufficiency condition is stressed. For the specific case of the elastic scattering by He in the Hartree approximation, this prescription gives better results than Hulthén's or Kohn's method. (auth)

7508 A "CENTRE OF GRAVITY" THEOREM IN SECOND ORDER. P. Van Leuven (Studiecentrum voor Kernenergie, Mol, Belg.). Nucl. Phys., 38: 623-8(Nov. 1962). (In English)

The energy spectrum of a system consisting of a nucleon coupled to a spherical core, performing harmonic 2^k-pole vibrations of frequency ω, is considered in second-order perturbation theory. It is found that the separation between the centers of gravity of the "core-multiplets" differs for $\hbar\omega$ by a term which is small in most cases. (auth)

7509 PERTURBATION THEORY USING A REDUCED SET OF STATES. Jerome I. Kaplan (Brandeis Univ., Waltham, Mass.). Phys. Rev., 129: 644-6(Jan. 15, 1963).

A method is given whereby a second-order calculation of the energy due to a perturbation H_{en} of the zero-order Hamiltonian $H_e + H_p + e_p$ can be evaluated approximately using only the eigenstates ψ_e and relaxation times τ_{ep}. As an example the Ruderman-Kittel formula for the exchange-type coupling of nuclear spins is re-evaluated. (auth)

7510 ANALYTIC APPROXIMATION TO THE LOW-ENERGY SOLUTIONS OF INVERSE AMPLITUDE DISPERSION RELATIONS. I. R. Gatland and J. W. Moffat (RIAS, Baltimore). Phys. Rev., 129: 937-40(Jan. 15, 1963).

An analytical approximation to the solution of the inverse amplitude dispersion relations exhibiting two resonances with the same quantum numbers is presented. It is shown that, given a solution exhibiting one resonance, a double resonance solution can be produced without violating crossing symmetry if a CDD (Castillejo, Dalitz, and Dyson) pole is inserted near the original resonance position. In the presence of inelastic scattering the CDD pole must be off the real axis and will occur on an unphysical sheet. For various values of the pion-pion coupling constant in the range $-0.15 \leq \lambda \leq -0.1$ the masses and widths of the ζ and ρ resonances are calculated. (auth)

7511 QUANTUM STATISTICAL MECHANICS OF A MANY-BODY SYSTEM WITH SEVERAL COMPONENTS. R. K. Pathria and M. P. Kawatra (Univ. of Delhi). Phys. Rev., 129: 944-59(Jan. 15, 1963).

The binary collision method of Lee and Yang is extended in order to investigate the statistical mechanics of a multicomponent mixture of interacting gases obeying Bose-Einstein or Fermi-Dirac statistics. First, the case of a mixture of two kinds of hard-sphere spinless bosons is studied and then the generalization is carried over to the case of a mixture of several components consisting of particles with arbitrary spin and statistics. An explicit derivation of the fugacity expansion, correct to the second order in the interaction parameters, is given. Expressions are derived for the second and third virial coefficients of the system and a discussion is given of the salient features of the results obtained. Finally, the case of a binary mixture, with one component consisting of bosons and the other of fermions, is considered and the phenomenon of Bose-Einstein condensation in this system is studied. (auth)

7512 DISPERSION-THEORETIC IMPULSE APPROXIMATION FOR POTENTIAL SCATTERING. Leonard Rosenberg (Univ. of Pennsylvaniz, Philadelphia). Phys. Rev., 129: 968-73(Jan. 15, 1963).

In the impulse approximation for the scattering of a particle by a bound system, the amplitude is a sum of integrals over two-body scattering amplitudes, off the energy shell, folded into bound-state wave functions. In the usual formulation, the nonphysical two-body amplitudes are replaced by physical amplitudes with no firm justification for this procedure. The dispersion-theoretic formulation presented here, for elastic scattering, removes this difficulty; for low values of t, the momentum transfer squared, the discontinuity across the cut in the t plane can be expressed in terms of the absorptive part of the physical two-body amplitude and the asymptotic form of the bound-state wave function. Working with a nonrelativistic model, it is shown that the Cutkosky method for finding absorptive parts of Feynman amplitudes applies here as well. The analyticity of the amplitude is a conjecture, based on a proof that the second and third Born approximations satisfy a Mandelstam representation. The method of this proof is an adaptation of techniques recently developed by Eden and others in the relativistic case. (auth)

7513 REGGE POLES AND INELASTIC SCATTERING AT HIGH ENERGIES. A. P. Contogouris, S. C. Frautschi, and How-sen Wong (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 129: 974-81(Jan. 15, 1963).

The Regge pole hypothesis is applied to some inelastic processes at high energies. Particular attention is given to production of pion-nucleon resonances N^* in the reaction $N + N \rightarrow N + N^*$. Data on production of the $I = \frac{1}{2}$ resonances are interpreted in terms of exchange of the "Pomeranchuk" Regge pole which is believed to be responsible for the diffraction peaks in elastic reactions, and production of the 3-3 resonance is interpreted in terms of exchange of the pion Regge pole. The prediction is obtained that production and decay of the $I = \frac{1}{2}$ resonances provides secondary pions and neutrons with energies that rise proportionally to the incident proton energy—a result of interest in connection with the secondary beams in future accelerators. (auth)

7514 A SPACE-TIME APPROACH TO THE QUANTUM FIELD THEORY. G. V. Ryazanov. Zh. Eksperim. i Teor. Fiz., 43: 1281-7(Oct. 1962). (In Russian)

An attempt is made to replace the quantum field theory by trajectory statistics with changing direction of time. The general expression for quantum-mechanical probabilities is supplemented by arguments concerning the character of random particle motion along trajectories with changing direction of time. The wave properties of micro-particles follow almost automatically from the notion of particles capable of moving both forwards and backwards in time. In this connection, the possibility is discussed of constructing a quantum field theory on the basis of a small number of simple postulates. (auth)

7515 INTEGRAL REPRESENTATIONS IN PERTURBATION THEORY. A. Z. Patashinskii (Inst. of Heat Physics, Academy of Sciences, Siberian SSR). Zh. Eksperim. i. Teor. Fiz., 43: 1371-7(Oct. 1962). (In Russian)

A study is made of integral representations obtained on the basis of perturbation theory of the boundaries of a region where the spectral function becomes zero for the case of equal masses. (auth)

7516 THE PROBLEM OF "SURFACE" DIVERGENCES IN THE BOGOLYUBOV METHOD. A. D. Sukhanov (Inst. of Mathematics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1400-10(Oct. 1962). (In Russian)

A procedure is proposed of supplementary regularization that permits obtaining, within the framework of the Bogolyubov method, a matrix $S(\sigma, -\infty)$ not containing surface divergences (for fixed regularizational masses M_1^2). The additional counter-terms which thus appear with arbitrary finite coefficients make a contribution only on the surface σ and may be eliminated from the matrix $S(\sigma, -\infty)$ into an unitary operator, which is not physically essential. Also are considered certain peculiarities of obtaining the interaction Hamiltonian in the Bogolyubov method. The question of passing to the limit $M_1^2 \rightarrow \infty$ in the matrix $S(\sigma, -\infty)$ remains open. However, irrespective of its solution, the proposed procedure makes it possible to obtain consistently the ordinary expression for the S-matrix on the basis of the Tomonaga–Schwinger equation. (auth)

7517 THE THREE BODY PROBLEM FOR SHORT RANGE FORCES IN THE LINEAR APPROXIMATION IN THE FORCE RANGE. G. S. Danilov (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1424-35(Oct. 1962). (In Russian)

Equations for the scattering amplitude of a three particle system are derived for the case of resonance short range forces between the particles in the linear approximation in $|E|^{1/4} r_0$, where E is the system energy and r_0 the force range. In this approximation the scattering amplitude can be expressed in terms of the zero energy pair amplitudes, three particle bound state energy, and force range. (auth)

7518 THE ROLE OF SHORT-RANGE THREE-PARTICLE FORCES IN PROCESSES WITH THE GENERATION OF THREE PARTICLES NEAR THRESHOLD. G. S. Danilov (Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1436-47(Oct. 1962). (In Russian)

The role of three-particle short-range forces is considered in reactions with the formation of three particles near the threshold of the reaction on the condition that the pair forces are also short-range. It is shown that when all pair amplitudes at zero energy $a_{ik} \sim r_0$, where r_0 is the radius of action of the forces, or when one of the amplitudes, for instance, $|a_{23}| \geq r_0$, whereas $a_{12} \sim r_0$, $a_{13} \sim r_0$, three-particle forces under certain conditions can appreciably alter the energy dependence of the amplitude of the reaction. (auth)

7519 ON THE MASS OF A COMPLEX VECTOR FIELD. I. B. Khriplovich (Inst. of Nuclear Physics, Academy of Sciences, Siberian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1493-5(Oct. 1962). (In Russian)

It is shown that a nonmass complex vector field interacting with an electromagnetic field loses gradient invariance of the second kind. For this reason, a charged vector meson acquires an electromagnetic mass even in the absence of the bare mass. In this case, its mass is determined by the cut-off parameter and the coupling constant. (auth)

7520 THEORY OF RELATIVISTIC COULOMB SCATTERING. [PART] II. V. G. Gorshkov (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1714-26(Nov. 1962). (In Russian)

Formulas for the cross section for elastic scattering of electrons on nuclei are derived by taking into account screening and the finite size of the nucleus. The Laplace transformation for the scattering charge density and expansion of the matrix elements in the transformation parameter are employed. (auth)

7521 EXPANSION OF SCATTERING AMPLITUDE IN RELATIVISTIC SPHERICAL FUNCTIONS. I. S. Shapiro (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1727-30(Nov. 1962). (In Russian)

An expansion is given of scattering amplitude in relativistic spherical functions. A unitarity relation is obtained for relativistic partial amplitudes with a given four-dimensional angular momentum. The analytic properties of partial amplitudes as functions of four-dimensional turning moments are discussed. (auth)

7522 ON INELASTIC DIFFRACTION PROCESSES AT HIGH ENERGIES. E. D. Zhizhin and Yu. P. Nikitin. Zh. Eksperim. i Teor. Fiz., 43: 1731-42(Nov. 1962). (In Russian)

It is demonstrated that the cross sections for inelastic processes due to diffraction of fast particles on nuclei can be calculated on the basis of the diagram technique. Vertex functions are obtained which describe elastic diffractional scattering and which should be inserted in the diagrams for inelastic diffractional processes. The differential and total cross sections for diffractional production of π mesons and strange particles by interaction between fast protons and nuclei and also for diffractional nucleon–antinucleon pair production due to last π-meson encounters with nuclei and diffractional π-meson pair production by high energy γ-quanta are calculated on the basis of the black spherical nucleus model. (auth)

7523 ON THE THEORY OF QUANTUM GENERATORS. T. I. Kuznetsova and S. G. Rautian (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 1897-1903 (Nov. 1962). (In Russian)

A plane monochromatic solution for the electromagnetic field inside a layer with a negative absorption coefficient is considered. (auth)

7524 FEYNMAN AMPLITUDES FOR NONRELATIVISTIC PROCESSES. L. D. Blokhintsev, E. I. Dolinskii, and V. S. Popov (Moscow State Univ. and Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1914-26(Nov. 1962). (In Russian)

A limiting expression $F_{nl}^{(0)}$ for the relativistic amplitude F_{nl}^{r} of an arbitrary Feynman graph, all internal lines of which represent scalar particles (n is the number of internal lines and l the number of independent contours), is found in the case when the kinetic energy transferred in the external vertices and the energy yield in each diagram vertex are small compared to the virtual particle masses. For $n > 5l/2$, $F_{nl}^{(0)}$ is identical to the nonrelativistic amplitude considered in [2,3]. For $n < 5l/2$, amplitude $F_{nl}^{(0)}$ does not depend on nonrelativistic invariants and does not possess singularities in the nonrelativistic region. For $n = 5l/2$, amplitude $F_{nl}^{(0)}$ logarithmically depends on nonrelativistic invariants. The order of magnitude of relativistic corrections to $F_{nl}^{(0)}$ is found. An explicit expression for relativistic corrections to single-loop diagrams is derived. The numerical value of relativistic corrections as a function of the incident particle energy is obtained for triangular diagrams of direct nuclear reactions of the A + x → B + y type. The results are extended to particles with an arbitrary spin. (auth)

7525 ON ASYMPTOTIC REPRESENTATIONS OF THE GREEN'S FUNCTIONS AND VERTEX FUNCTION IN QUANTUM ELECTRODYNAMICS. P. I. Fomin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 43: 1934-9(Nov. 1962). (In Russian)

Asymptotic representations of the Gell-Mann and Low type are obtained for the electron Green's function and vertex function regularized according to Dyson, the dependence of the functions on λ_0, the fictitious photon mass, being taken into account. The procedure is based on the renormalizability of quantum electrodynamics and the existence of limits of the nonrenormalized functions for zero values of the electron mass and fictitious photon mass λ_0. Some consequences of the asymptotic representations which follow from the assumption that the functions can be expanded in power series in e^2 are considered. (auth)

7526 REGGE POLES AND LANDAU SINGULARITIES. V. N. Gribov and I. Ya. Pomeranchuk (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR and Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 43: 1970-5(Nov. 1962). (In Russian)

It is shown that at an energy $\sqrt{t} = \sqrt{t_1}$ equal to any two-particle threshold, condensation of an infinite number of Regge poles occurs on the line $\mathrm{Re}\, l = -1/2$. This result signifies, in particular, that the invariant scattering amplitude of two zero spin particles cannot, at a value of t equal to any two-particle threshold, decrease faster than $1/\sqrt{s}$ with growth of s. This statement is a consequence of unitarity and analyticity. The proof of pole condensation requires that the interaction range be finite at a given energy. It is proven that interaction consistent with unitarity and analyticity in the nonrelativistic limiting case cannot be repulsive at all distances. (auth)

7527 MATHEMATICAL APPARATUS OF THE THEORY OF ANGULAR MOMENTUM. (Matematicheskii Aparat Teorii Momenta Kolichestva Dvizheniya). A. P. Yutsis, I. B. Levinson, and V. V. Vanagas. Translation by A. Sen and R. N. Sen of Lietuvos TSR Mokslu Akad. Darbai, No. 3, 1960. 167p. (NASA TT F-98; PST Cat. No. 816). $1.75(OTS).

The quantum theory of angular momenta is reviewed, with attention to the addition of two or more angular momenta; graphical methods; operations involving Wigner, Clebsch-Gordan, and j-coefficients; transformation matrices; and matrix elements of irreducible tensor operators. (T.F.H.)

REACTOR TECHNOLOGY

General and Miscellaneous

Refer also to abstracts 6311, 6742, and 7131.

7528 (AE-87) MEASUREMENTS OF BURNOUT CONDITIONS FOR FLOW OF BOILING WATER IN VERTICAL ROUND DUCTS. Kurt M. Becker (Aktiebolaget Atomenergi, Stockholm). 1962. 38p.

The first phase of an experimental investigation of burnout conditions for flow of boiling water in vertical round ducts is reported. The results are presented in diagrams where, for a certain geometry, the burnout steam quality. x_{BO}, was plotted against the pressure with the surface heat flux as parameter. The data have been correlated by curves. The scatter of the data around the curves is less than ±5%. In the ranges investigated the observed steam quality at burnout, x_{BO}, generally decreases with increasing heat flux, increases with increasing pressure, and decreases with increasing mass velocity. The mass velocity effect has been explained on the basis of climbing film flow theory. For engineering purposes, the effects of inlet subcooling and channel length have been found to be negligible. (R.J.S.)

7529 (AEEW-R-179) STATISTICAL ESTIMATION OF NUCLEAR REACTOR DYNAMIC PARAMETERS. J. D. Cummins (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Feb. 1962. 90p.

The noise in nuclear reactors and associated power plant is studied. Parameters which influence the dynamic behavior of some reactors are specified and their effect on dynamic performance is described. Methods of estimating dynamic parameters using statistical signals are described in detail together with descriptions of the usefulness of the results, the accuracy, and related topics. Some experiments performed on nuclear reactors are described. A digital computer program is described. The computer program derives the correlation functions and the spectra of signals. The program will compute the frequency response both gain and phase for physical items of plant for which simultaneous recordings of input and output signal variations have been made. Estimations of the accuracy of the correlation functions and the spectra may be computed using the program and the amplitude distribution of signals may also be computed. The program is written in autocode for the Ferranti Mercury computer. A practical example of the use of the method and the digital program is presented. In order to eliminate difficulties of interpretation a very simple plant model was chosen i.e., a simple first order lag. Several interesting properties of statistical signals were measured and discussed. (auth)

7530 (AEEW-R-189) COMPUTER PROGRAMME FOR THE DERIVATION OF TRANSFER FUNCTIONS FOR MULTIVARIABLE SYSTEMS (SOLUTIONS OF DETERMINANTS WITH POLYNOMIAL ELEMENTS). C. B. Guppy (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Mar. 1962. 43p.

Transfer functions in the form of the ratio of two polynomials of the complex variable s are derived from sets of Laplace transformed simultaneous differential equations. The set of algebraic simultaneous equations are solved using Cramer's Rule and this gives rise to determinants having polynomial elements. It is shown how the determinants are formed when transfer functions are specified. The procedure for finding the polynomial coefficients from a given determinant is fully described. The first method adopted is a direct one and reduces a determinant with first degree polynomial elements to secular form and follows this by an application of the similarity transformation to reduce the determinant to a form from which the polynomial coefficients can be read out directly. The programme is able to solve a single determinant with polynomial elements and this can be used to reduce an eigenvalue program in the form of a secular determinant to polynomial form if the need arises. A description is given of the way in which the data are to be set out for solution by the program. A description is also given of a method used in an earlier program for solving polynomial determinants by curve fitting techniques using Chebyshev Polynomials. In this method determinants with polynomial elements of any degree can be solved. (auth)

7531 (AEEW-R-197) TRANSFER FUNCTION SYNTHESIS FOR REACTOR SPATIAL DYNAMICS USING THE MODAL APPROACH. C. B. Guppy (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Aug. 1962. 55p.

Techniques are developed which will enable the construction of transfer functions relating changes in variables such as power or neutron flux with reactivity perturbations when there is a need for taking into account spatial effects within a reactor. Initially each of the transfer functions derived comprises the sum of a series of harmonics each of which has a Laplace transform with associated spatial eigenfunction. Series of this kind can then be reduced to pure polynomial form (numerators on denominators) the coefficients of which have implicit allowance for spatial effects. The existence of large reactors having several independent controllers make necessary a knowledge of transfer functions of this form. The technique will allow the characteristics of each controlled sector to be obtained as well as the characteristics of the complete control system with its couplings through the reactor core. In addition, the developing use of frequency response testing of reactors makes necessary a knowledge of the spatial behavior to be expected of a reactor under test. (auth)

7532 (ARF-K6018-3) STUDIES OF REACTOR CONTAINMENT. Bimonthly Progress Report, September–October 1962. P. Lieberman (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Contract AT(11-1)-578. 41p.

A computer program is being developed for the solution to propagation of stress waves generated in a one-dimensional, homogeneous material subjected to an impulse loading. A stress sensor is being used for the determination of the unloading isentropes of balsa. The problem of explosive decompression of reactor coolant water is discussed. (R.J.S.)

7533 (BNL-5412) FLUX FLATTENING BY VARIATION OF RESONANCE ESCAPE PROBABILITY. James R. Powell (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract [AT(30-2)-Gen-16]. 8p.

Flux flattening by nonuniform fuel loading and nonuniform moderation was proposed. It is noted that the use of non-

uniform moderation usually causes P, the resonance escape probability, to vary in most practical reactors. An alternate method is to vary P by changing the S/M ratio of the fuel, keeping the fuel loading and moderation uniform. For certain choices of reactor and reflector, a comparatively small variation in P is necessary. Two-group equations are included for a uniform loading, uniform thermal flux, and uniform moderation. Two critical equations are also included along with an example of flux flattening by variation of P. (J.R.D.)

7534 (BNL-5891) THE EFFECT OF GRAPHITE CHEMICAL REACTIVITY ON THERMAL INSTABILITY CONDITIONS IN AIR-COOLED CHANNELS. Donald G. Schweitzer (Brookhaven National Lab., Upton, N. Y.). [Feb. 1962]. Contract [AT(30-2)-Gen-16]. 8p.

Conditions leading to thermal instability in air-cooled channels are mathematically expressed. It is shown that thermal instability occurs only if the air temperature approaches the graphite temperature. The length of channel necessary to yield a particular air temperature is derived. The effects of enhanced reactivities on the instability conditions are discussed. (R.J.S.)

7535 (CEA-2201) ETUDE D'UN REACTEUR A COMBUSTIBLE LEGEREMENT ENRICHI (RUBEOLE) A L'AIDE DE SOURCES PULSEES DE NEUTRONS. (Study of a Slightly Enriched R Reactor Fuel by Means of a Pulsed Neutron Source). M. Sagot and H. Tellier (France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucléairez, Saclay). Apr. 1962. 48p.

A BeO moderated reactor using slightly enriched uranium oxide as fuel was studied by the pulsed neutron source technique. The neutron lifetime was measured in two different cores without reflector, then attempts were made at the measurement of great negative reactivities introduced into the reactor under the following forms: decrease of the volume of the unreflected core, introduction of absorbing cadmium rods, removal of fuel at the periphery of the critical core while maintaining a constant height, and substitution of fuel elements by less reactive elements. In all cases, the results are compared with the data obtained by another type of experiment or by computation. (auth)

7536 (CRIO-1115) EXTENDING REACTOR TIME-TO-POISON BY PRE-SHUTDOWN POWER ALTERATIONS. R. E. Kerr and W. C. Lennox (Atomic Energy of Canada Ltd., Chalk River, Ont.). Sept. 1962. 25p. (AECL-1619)

Consideration was given to the extension of time-to-poison by pre-shutdown power alterations which involve a minimum of lost reactor production. It was concluded that no direct solution to this problem is available. A preliminary investigation, with power altered in a step-wise manner, indicated that a possible criterion for optimizing the lost power production is to keep the xenon level at as high a level as possible during all stages of power alteration except the last. This approach is the basis of a computer code for the Bendix G-20 computer, which generates a power pattern for a required time-to-poison. Results of applying this to various situations in the NRU reactor are given. (auth)

7537 (DC-61-4-37) PRELIMINARY DESIGN NOTES (REVISED). M. E. Lapides (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Apr. 14, 1961. Contract AT(11-1)-171. 191p.

A summary and revision of source material are presented which were found to be useful in the Power Systems Design and Evaluations Unit of GE-ANPD. Included are design studies and data summaries which illustrate fuel element design analysis in terms of power extraction. The notes were originally prepared to facilitate preliminary design analysis by illustrating information required for reasonable design qualification. Previous experience with these notes has suggested that they may be of value in expediting design studies. (W.D.M.)

7538 (DCAS-TDR-62-44) PROPULSION RESEARCH PROGRAM. SUMMARY OF RESEARCH IN THE FIELD OF ADVANCED NUCLEAR PROPULSION. Semiannual Technical Report, July 1–December 31, 1961. M. L. Rosenzweig (Aerospace Corp., El Segundo, Calif.). Mar. 10, 1962. Contract AF04(647)-930. 62p. (AD-276094; TDR-930(2210-14)TR-1)

A summary is presented of research progress in the field of Advanced Nuclear Propulsion for the period July 1 to December 31, 1961. The research program includes both analytical and experimental investigations of single and multiple vortex systems. Experimental apparatus is described. A comparison of the relative performance of the vortex matrix and single-cell vortex is presented as well as other theoretical and experimental results. Future program plans are summarized. (auth)

7539 (EURAEC-384) HYDRODYNAMIC INSTABILITIES RESTRICTING THE POWER OF BOILING WATER REACTORS. Quarterly Report No. 1, March 15–June 15, 1962. (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Grenoble). July 1, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 076-12-RDF. 55p.

Experiments with two low-pressure loops with simple geometry channels for basic research on power phenomena are described. In tests aimed at determining parameters of pressure loss in the boiling channel used for instability tests, it was possible by heavy rolling in the channel input to operate in a stable manner at temperatures, velocities, and powers corresponding to oscillatory states in former experiments. Stable states were found in superheating conditions at the wall when the temperature exceeded 400°C. Research on instability thresholds and oscillation periods was also conducted with a small convection loop and a forced-convection loop. Results indicated that at a specified power, a large measure of stability reappeared under test conditions. (J.R.D.)

7540 (GA-2749) FEVER—A ONE-DIMENSIONAL FEW-GROUP DEPLETION PROGRAM FOR REACTOR ANALYSIS. F. Todt (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Nov. 28, 1962. Contract AT(04-3)-314. 223p.

The one-dimensional diffusion-theory depletion program FEVER, written in FORTRAN-II for a 32,000-word computer is described. The code allows for the representation of self-shielded burnable poisons and provides methods for automatically adjusting control poisons in various regions of the reactor according to some specified sequence. No intermediate tape manipulation is required during the calculations, since all program and data storage are contained in the fast memory of the computer. Information oriented to meet the needs of the potential user of the program and a documentation of the programming details. are presented. (auth)

7541 (GEAP-4047) DEVELOPMENT OF PULSED NEUTRON APPLICATION TO POWER REACTOR START-UP PROCEDURES. First Quarterly Progress Report, April 1–June 30, 1962. Paul Meyer and Edward Garelis (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). July 1, 1962. Contract AT(04-3)-189. 28p.

Activities in a program to develop techniques in the

use of pulsed neutron sources to measure shutdown parameters related to large thermal power reactors are reported. The experimental work centers around aspects of detecting neutrons in the presence of 10^7 r/hr gamma fields. The feasibility of U^{235} coated solid state detectors for use in these measurements is being studied. A theoretical investigation is also in progress on the effects of a multi-region assembly on the fundamental decay constant of injected bursts of neutrons. Other work is reported on the time-dependent neutron thermalization for bare multiplying media, particular attention is directed to the exponential time decay for pulsed bare multiplying homogeneous assemblies. Numerical expressions are given for the fundamental eigenfunction and eigenvalue to the first and second order, respectively. An explicit analytical expression for the eigenfunction is included. (J.R.D.)

7542 (GEMP-75) REACTOR INSTRUMENTATION AND CONTROL PROGRESS REPORT NO. 75. (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). Nov. 30, 1962. Contract AT(40-1)-2847. 45p.

In developmental work on the circulating-ball reactivity control, a value was designed which will permit selective operation between the shim and scram functions. Tests of a modified electromagnetic drive control activator and a rod-position sensor are described. In other work, a two-out-of-three logic circuit was constructed and a latching circuit was tested. Work on temperature sensors is reported in which yttria specimens of various densities were tested and a beryllia sensor was operated in air for 415 hrs. Work on high-temperature nuclear sensors included testing of fission counters to 1500°F, testing of fission counter components, and testing of d-c ionization chambers at 1000°F. The final status of the Monte Carlo computer programs and the auxiliary programs is presented. (J.R.D.)

7543 (HW-70501) DEFORMATION OF SHAPED CYLINDRICAL REACTOR FUEL ELEMENTS. K. R. Merckx (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 16, 1962. Contract [AT(45-1)-1350]. 26p.

Numerical methods of analysis are described for corrugated reactor fuel elements. The analysis assumes that the fuel exerts a uniform pressure on an elastically deforming cladding. Numerical results are obtained for corrugated cladding formed by tangential circular arcs. Maximum bending stresses are plotted versus ratio of inner-arc radius to outer-arc radius for 6-, 8-, and 10-lobed elements. Minimal stress conditions occur in the inner to outer-arc radii ratios of 0.2 to 0.4 with the small values for small arc length to base circle length ratios and low number of lobes. (auth)

7544 (HW-71232) PuO_2–UO_2 EURATOM TEST ELEMENTS. J. B. Burnham, Jr. (General Electric Co.; Hanford Atomic Products Operation, Richland, Wash.). Sept. 29, 1961. Contract [AT(45-1)-1350]. 36p.

Twenty-one Zircaloy tubes were loaded with UO_2–1.5 PuO_2 sintered pellets. Analysis showed the average pellet density to be greater than 93% TD. The O to U ratio was 2.018; the average Pu content was 1.47 wt %. (auth)

7545 (HW-72304) A HEURISTIC STUDY OF PLUTONIUM VALUE IN A FAST OXIDE BREEDER. P. L. Hofmann and G. J. Busselman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 15, 1962. Contract [AT(45-1)-1350]. 17p.

Results of an investigation concerning the indifference values of Pu are presented. It is noted that if the range of Pu compositions is limited, it may be possible to obtain approximately constant values for some of the Pu isotopes. The investigation was conducted to obtain an indication of Pu value in a fast spectrum reactor, to trace the changing value of Pu in a fast reactor, and to assign indifference values to at least some Pu isotopes. Results indicate that Pu^{239} has an appreciably higher value than U^{235} in fast reactors and that thermally exposed Pu containing high fractions of Pu^{241} is a more desirable fuel for fast reactors. (J.R.D.)

7546 (HW-74761) RESEARCH AND DEVELOPMENT PROGRAMS EXECUTED FOR THE DIVISION OF REACTOR DEVELOPMENT. Quarterly Progress Report, April–June 1962. W. A. Snyder and J. E. Brown, eds. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 15, 1962. Contract AT(45-1)-1350. 274p.

Progress is reported on plutonium fuels, ceramic uranium fuel, physics, chemical research and development, analytical studies and advanced concepts, materials development, and corrosion and heat transfer studies, irradiation effects on materials, gas-cooled reactor studies, instrumentation and nondestructive testing, and the Plutonium Recycle Test Reactor. Separate Abstracts were prepared for each topic. (M.C.G.)

7547 (HW-74761(p.3.1-39) III. PLUTONIUM FUELS. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Thirty UO_2–PuO_2 19-rod cluster fuel elements were produced and transferred to the Plutonium Recycle Test Reactor (PRTR) to meet the advanced core loading schedule for uniformly enriched fuel elements. Eighteen of these elements were fabricated by a cold swage compaction process and twelve by a vibratory compaction process. For cold swaging, a blend of feed material designated "HZP" repeatedly produced a core loading in the required weight range. Studies to improve the uniformity of the core loading are continuing. Densities of the vibrationally compacted rods ranged from 85 to 90% of theoretical. PuO_2 dispersion is within ±5% of the nominal composition. A zirconium-clad Pu–Zr alloy core fuel plate was made by roll cladding as an initial step in the development of an extended surface, one-piece plutonium fuel element. With the elimination of the aluminum foil for contamination control, no intermetallics were detected and the fuel density per unit area appeared uniform. Taper reaming of the swageable oxide rods corrected incomplete weld penetration on swageable end caps. Wire wrap welding improvements eliminated the possibility of embrittlement in the weld zone. A Zircaloy-clad 19-rod cluster containing MgO–PuO_2 and a similar cluster containing ZrO_2–PuO_2 are being fabricated by swage compaction for irradiation testing in the PRTR. Fused, pure MgO and fused, stabilized ZrO_2 (5 wt% CaO added) are the inert diluents. Each element contains 371 grams of PuO_2. Three thin-walled stainless steel-clad UO_2–PuO_2 19-rod clusters are being fabricated by vibratory compaction. Cladding materials are 0.008-inch-thick 304 L seamless tubing and 0.010-inch-thick AISI 406 type stainless steel tubing. Irradiated fuel rods from the 7-rod cluster of uniformly enriched UO_2–PuO_2 and the 7-rod cluster of cosine enriched UO_2–PuO_2 were analyzed for total gas release. The rods operating at higher temperatures released less gas than those operating at lower temperatures. The higher temperatures, however, were not high enough to cause center core melting. There was no discernible difference between outgassed and unoutgassed fuel material. Methods of preparation and properties of various plutonium ceramic materials are being determined. Additional thermal expansion data were obtained on PuO_2 up to 1620°C. The expansion

was uniform to about 1275°C and then increased sharply. The experiments on lattice constants and phase relations of arc melted PuC alloys were completed. A uniform PuC lattice constant and existence of Pu_2C_3 indicated a stable two-phase region above 49.1 at.% C. As carbon content was decreased, the Pu_2C_3 phase disappears and only a single PuC phase exists over the range 39.8 to 49.1 at.% C. The unusual behavior of the lattice constant below 39.8 at.% C is indicative of an extremely nonequilibrium condition. (auth)

7548 (HW-74761(p.4.1-47)) IV. CERAMIC URANIUM FUEL. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

UO_2 fuel elements irradiated in the PRTR were inspected after discharge from the reactor. Only two fuel elements bore visual evidence of damage. High voltage electron beam welding experiments hold promise for fabrication of internally cooled fuel elements which until recently were considered impracticable because of welding problems. The feasibility of remote fabrication of a complex fuel element was demonstrated by simultaneous compaction of all three components of a nested tubular fuel element. Intensive study of irradiation effects in uranium dioxide single crystals is continuing to provide a fundamental understanding of UO_2 behavior as a reactor fuel. Studies on the microhardness, etching characteristics, thermal conductivity, high temperature ductility, and specific volume of UO_2 were made. High energy impaction techniques were investigated that can convert UO_2 powder to ultrahigh density (>99% TD) fuel particles suitable for core material in vibrationally compacted or swaged fuel elements. Burn-up values for UO_2 fuels obtained by cesium determination are often inaccurate because of relocation of the cesium in high temperature gradients. Consequently, a new procedure involving refinements in sampling methods and material balance controls was developed. Improved thermal conductivity measurements and ceramographic techniques provided data which permit quantitative analyses of the factors contributing to the characteristic structure of irradiated UO_2. (auth)

7549 (HW-74761(p.5.1-35)) V. PHYSICS. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

The use of lutetium as a spectral index detector was studied. Data are presented for correcting lutetium activity measurements from thick foils to that with thin foils. Subcritical experiments with 1.82 wt% Pu–Al rods in light water were conducted as part of the series of experiments which utilize plutonium containing various concentrations of the isotope Pu^{240}. The experiments furnish critical mass data which allow more accurate nuclear safety specifications to be set for the reprocessing of plutonium fuels and which can be used as check points in the calculation of light water moderated lattices containing plutonium. The experiments were conducted using critical approach and exponential measurement techniques. A brief study was conducted to examine the applicability of the Westcott scheme to the analysis of some plutonium-aluminum-H_2O assemblies and to suggest some possible prescriptions for survey calculations of reactor types not readily described by means of the Westcott cross section routines. Many of the simpler reactor surveys employ point reactor calculations. Calculations of this type can be meaningful if they are normalized to experimental values or are calibrated by more refined models. In addition to the point reactor systems, one-dimensional calculations were made for the same series of experiments using a three-group diffusion theory physics model. (auth)

7550 (HW-74761(p.6.1-20)) VI. CHEMICAL RESEARCH AND DEVELOPMENT. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Earlier work on the use of lithium-potassium-chloride melts as reaction media for the salt cycle process was extended to a study of decontamination effects attending the electrodeposition of UO_2 in the same melts. Using LiCl–KCl melt, separation factors of from 50 to 100 were measured for the separation of uranium oxide from plutonium. The separation factor was increased from 50 to 100 by halving the cathode potential and current density. Improvement of PuO_2–UO_2 co-deposition under partition conditions was attempted by addition of 2 wt% thallium as TlCl to a 2.6 LiCl–NaCl–KCl (5.0 wt% uranium, 1.5 wt% plutonium) melt prior to electrolysis. The PuO_2/UO_2 ratio in the deposit was indeed found to be higher by a factor of three than in the absence of thallium. Pilot plant electrolysis tests were continued with the KCl–LiCl molten salt system. The UO_2 dissolution rate, melt drying time cycle, electrolysis voltage, and purity effects on UO_2 deposits were investigated for the molten salt systems. It is estimated that a 100-lb batch of U_3O_8 could be dissolved in 12 hours and dried in two hours with very little difficulty. Testing of the radiant heat, spray calciner equipment was continued concurrently with decontamination and clearing of the A Cell of the High Level Radiochemistry Facility. These tests were nonradioactive experiments designed to demonstrate equipment performance, off-gas decontamination, denitration, desulfation, and melt formation of simulated wastes. Equilibrium constants (K_c) and exchange capacities were determined for several commercially available synthetic zeolites. A clinoptilolite-like zeolite was also synthesized. A flowsheet was conceived for the removal, gross purification, and concentration of cesium from Purex formaldehyde-treated waste. Cesium and some sodium are absorbed in clinoptilolite while other cations are only slightly absorbed. Sodium is removed with dilute acid and cesium is eluted with ammonium carbonate. The cesium is purified and concentrated by volatilization of the ammonium carbonate and subsequent loading into a high capacity exchanger for storage and future recovery as required. Separation of cesium from mixed fission products by adsorption and elution with clinoptilolite was investigated. Experiments were continued in the micro-pilot plant to simplify and optimize an ion exchange process for decontaminating fuel reprocessing plant condensate waste streams. Operation of ion exchange columns without activated carbon pretreatment of the condensate was successfully demonstrated. (auth)

7551 (HW-74761(p.7.1-28)) VII. ANALYTICAL STUDIES AND ADVANCED CONCEPTS. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

The MELEAGER code was developed for rapid survey of a wide variety of fuel cycles. In its makeup certain simplications were necessary which appeared to limit the code's applicability to relatively light plutonium concentrations. By adjusting the self-shielding factors of the plutonium isotopes, it was not shown that the MELEAGER code can be made to "track" more rigorous codes and will reasonably represent plutonium burnout in reactor circumstances far beyond those possible by use of the classical flux and cross section model originally formulated by Westcott and used in MELEAGER. Possible applications of Phoenix fuels to other than compact reactors prompted study of Phoenix fuels at specific powers lower than those involved in many compact reactor applications. It appears that achievable Phoenix fuel exposures are substantially reduced at lowered specific powers. Analysis showed this

reduction to be connected with the decay of Pu^{241} (13-year half life); but the actual decrease in Phoenix fuel performance was caused by parasitic neutron capture in the decay product, Am^{241}, and not due to the associated decrease in Pu^{241} concentration. A brief study of the value of high exposure Pu as a fuel for fast reactors was conducted. Preliminary conclusions are that Pu^{239} has an appreciably higher value than U^{235} in fast reactors and Pu containing high fractions of Pu^{241} is an even more desirable fuel for fast reactors from a fuel cost viewpoint. A study was made of a compact plutonium-fueled fast reactor for spacecraft applications. A reactor size of 30 Mw, thermal (~5 Mwe) was selected as being of interest as a power source for ion propulsion engines and a larger spacecraft. The fuel was plutonium oxide with tantalum cladding. Coolants considered were boiling rubidium or potassium. A direct cycle system with turbogenerator power conversion was assumed. (auth)

7552 (HW-74761(p.8.1-15)) VIII. MATERIALS DEVELOPMENT, CORROSION, AND HEAT TRANSFER STUDIES. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Iron–nickel–aluminum alloys prepared at Hanford from high purity aluminum showed improved corrosion resistance over X-8001 in water at temperatures above 315°C. Improved corrosion behavior appears to depend on the presence of finely divided, uniformly dispersed, second-phase particles. It was concluded from zirconium alloy studies that alpha-phase Zircaloy-2 could not be charged with hydrogen beyond its terminal solubility (even under conditions of thermal cycling) if the hydrogen source was a film of ZrH_2 which completely covered the specimen surface. It appears that the charging of Zircaloy-2 with hydrogen beyond the terminal solubility and under conditions of aqueous corrosion is related to the existence of an oxide film on the specimen. To establish the performance of Zircaloy-2 as reactor pressure tube material, periodic nondestructive inspections of the PRTR Zircaloy-2 process tubes in situ were continued as part of the pressure tube monitoring program. Six process tubes (two from each of three alternate sextants of the reactor) were inspected at each scheduled reactor outage. Visual examinations confirmed that fretting corrosion was continuing at points where the fuel elements contact the inside wall of the process tubes. In the May outage, 16 tubes were examined and during June, the remaining 69 tubes were visually examined and four from the May inspection re-examined to determine the extent and magnitude of fretting corrosion. From the visual examinations made to date, the following general observations were obtained: upper and lower fuel element end brackets produce fretting corrosion in all tubes; in some tubes the spiral wire wrap of individual fuel rods produces fretting corrosion, mainly at locations near the ends of the fuel bundles; the spiral wire wrap on the UO_2 fuel bundles produced fretting corrosion at random locations along the length of the tubes; and strap or wire bands of circumferentially banded Pu–Al fuel bundles produced little or no fretting corrosion. Changes in the structural capacity of the PRTR pressure tubes during reactor use are being determined by tube removal and destructive testing. Heat transfer experiments were performed with two different, electrically heated models of a 19-rod bundle fuel element to determine the effects of rod spacing on boiling burnout. (auth)

7553 (HW-74761(p.9.1-37)) IX. IRRADIATION EFFECTS ON MATERIALS. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

An Extensometer was developed for creep capsules that permits in-reactor creep measurements. Zircaloy-2 was investigated for inreactor creep characteristics. Creep rates, in general, were lower during irradiation than those out-of-reactor; however, during reactor outages the rates increased. At the conclusion of the Engineering Test Reactor Cycle 45, a total of 548 irradiated specimens of Zircaloy-2 and AISI 304 and 347 SS were discharged. Of these specimens, 288 were shipped to HAPO for testing. The remainder were being prepared at the ETR for shipment in July, 1962. From these studies, two observations were made. First, most of the increases in strength and decreases in uniform strain with irradiation occur at relatively low exposures, this is a behavior typical of metals in general. Second, the directional effects in both strength and ductility noted in the unirradiated conditions are retained in the irradiated conditions in nearly equal magnitude. (auth)

7554 (HW-74761(p.10.1-6)) X. GAS-COOLED REACTOR STUDIES. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

A study of the oxidation characteristics of the EGCR Moderator was conducted at Hanford to provide a basis for estimation of potential combustion hazards in the event of a depressurization accident. An investigation was made of several factors to be applied to the basic oxidation rate for use in combustion calculations of graphite. On the basis of the maximum credible accident now postulated for the EGCR, a reliable oxidation inhibitor cannot yet be recommended that would effectively extinguish a fire or prevent one from starting. An additional 50,000 curies of Co^{60} were added to the Gamma Irradiation Facility, bringing the total amount in the source to 61,000 curies. Tests are continuing to determine the dimensional changes a lifetime radiation dose induces in EGCR graphite heated between 475 and 850°C in the General Electric Test Reactor at Vallecitos. The MGCR-HDR-3 Test was terminated on May 9 as scheduled. The test element was discharged without difficulty. The final total time at test reference conditions was 5,705 hours with temperatures ranging from 1500 to 1700°F. (auth)

7555 (HW-74761(p.11.1-14)) XI. INSTRUMENTATION AND NONDESTRUCTIVE TESTING. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Measurement equipment was designed and installed to determine PRTR moderator level fluctuation effects on the PRTR kinetics flux noise. The equipment will provide simultaneous time recordings of moderator level and neutron flux variations. Development was completed on a special monitor for detecting and measuring gamma emitters in liquid. An initial experimental instrument, which used a scintillation gamma detector and transistorized circuits, operated correctly in a test phase for two months. A final model was then designed and laboratory tested. Three complete monitors will be installed to satisfy the particular system requirements. Computer studies and calculations were performed during the quarter to establish optimum isotopic compositions for in-core flux detectors. Three fertile isotopes, U^{238}, U^{234}, and Pu^{240} appear to be of interest for use in regenerating detectors. The absorption cross sections are of the order of magnitude of 10, 100, and 1000 barns, respectively, with exact values dependent on spectral conditions. The computational problem consists of determining the initial combination of fertile and fissile isotopes that will provide the maximum useful lifetime in the reactor environment. Better methods

of experimentally evaluating a regenerating detector of optimum composition are being sought. An internal eddy-current test probe and an associated instrument were developed and placed in operation in the field. These were for testing 0.25-inch diameter Inconel tubing having a nominal wall thickness of 0.049 inch. The instrument promises to have useful application in the testing of other tubing also. A second model was fabricated for standby use and for further evaluation studies. Detection of hydriding in Zircaloy-2 is of interest due to the possibility of reactor component failures which could result from hydrogen embrittlement. Apparatus being developed to observe stress attenuation effects in Zircaloy-2 were tested on 2-S aluminum. Ultrasonic attenuation and velocity measurements were made on non-stressed Zircaloy-2 samples containing 0.0, 50.0, 100, 300, and 500 ppm hydrogen. Under the auspices of the USAEC/AECL Technical Advisory Committee, work is being done with Zircaloy tubing to develop a definitive ultrasonic test that could be used by tubing manufacturers. Production test development and evaluation work indicated that a tentative procedure for standardization and calibration can be formulated. Work was concentrated on longitudinal tests. All of the equipment necessary to set up a full-scale weir tank tube testing station was acquired and installation is nearly complete. (auth)

7556 (HW-74761(p.12.1-5)) XII. PLUTONIUM RECYCLE TEST REACTOR (PRTR). (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

The Plutonium Recycle Test Reactor operated 36 days during the quarter for a total production of 1883 Mwd. The reactor was shut down on June 3, 1962, for refueling and process tube examination. The UO_2 fuel elements were gradually replaced with UO_2-PuO_2 mixed oxide (moxtyl) fuel elements until at the end of the operating period, there were 11 moxtyl and 35 UO_2 fuel elements in the reactor. The total heavy water losses were 7354 lb for the quarter. The helium loss rate amounted to 329,500 standard cu. ft. A preliminary study of the hazards of changing from a three-zone loading of $UO_2-Pu-Al$ to a two-zone loading of PuO_2-moxtyl indicated greater reactor safety because of an increased negative temperature coefficient and no significant change in the delayed neutron fraction. A study was made of the feasibility of increasing the PRTR power level without making major alterations and with a modest investment in time and equipment. It was concluded that power could probably be increased to 100 Mw with a few changes in lesser items of equipment but that increases above 100 Mw would require extensive modifications. The electrical, instrumentation, moderator system, and the thimble coolant design tests for the Plutonium Recycle Critical Facility are greater than 75% completed. The fuel handling design tests are 25% complete. Plutonium Recycle Critical Facility final safeguards analysis was completed. Overall construction of the Fuel Element Rupture Test Facility is estimated to be 96% complete. The Gas-Cooled Loop Project is 91% complete. Final safeguard analyses for both facilities were completed. (auth)

7557 (HW-SA-2507) DEVELOPMENT OF REACTOR SAFETY STANDARDS. M. C. Leverett (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 27, 1962. Contract AT(45-1)-1350. 29p.

A description of standards for the safe design and operation of nuclear reactors being developed in the U. S. is presented. A discussion is included concerning the development status of these standards and the probable future trends. (J.R.D.)

7558 (HW-SA-2529) DEVELOPMENTS IN THE REACTOR PHYSICS OF PLUTONIUM IN LIGHT WATER. P. F. Gast (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 10, 1962. Contract AT(45-1)-1350. 30p.

The production of Pu as a by-product of the operation of power reactors using slightly enriched U has kindled an interest in the use of such material as a thermal reactor fuel. Because of the chain of Pu isotopes and their resonance structure, the reactor physics is more complex than is the case with U. The present cross section data are also less satisfactory. Some data on lattices of Pu-Al alloy rods in light water are presented and comparisons with data on aqueous solutions of Pu are drawn. Additional recent data on more concentrated solutions are presented and compared with the results of multi-group calculations. Results of a temperature coefficient measurement on Pu-Al fuel rods are also presented. A burnup code is described and some results of its application to a light water reactor are given. Efforts to develop improved codes are described with emphasis on the treatment of the spectrum problem with some examples of calculated spectra for water moderated plutonium fuel. Plans for future experimental work on Pu fueled light water lattices are presented. (auth)

7559 (JUL-76-RE) BESTIMMUNG VON KERNANORDNUNGEN KRITISCHEN MASSEN FUR VERSCHIEDENE IM FRJ-1 MERLIN. (Determination of Critical Masses for Different Core Arrangements in the FRJ-1 MERLIN). J. Jacquemin, W. Porschen, and P. A. Solari (Kernforschungsanlage, Jülich, Germany). Oct. 1962. 39p.

With the help of instruments, consisting of 3 measuring channels with BF_3 counting tubes as detectors, temporarily installed in the reactor tank, an approximation of the critical conditions of the reactor for various core configurations was accomplished. From the approximation curves the critical masses for the respective core arrangements were determined by extrapolation. The following values were obtained: for a square core $M_c = 2662.2 \pm 1.3$ g U^{235}, for a cruciform core $M_c = 2637.9 \pm 1.5$ g U^{235}, and for a BeO-reflected core $M_c = 2134$ g U^{235}. By installation of BeO reflector elements about 528 g of nuclear fuel could be saved. (tr-auth)

7560 (NAA-SR-7140) TEMPERATURE COEFFICIENTS AND SPECTRA IN THE HYDRIDE MODERATED SNAP REACTORS. J. Miller, R. L. Brehm, and W. J. Roberts (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Dec. 30, 1962. Contract AT(11-1)-Gen-8. 56p.

A summary of SNAP temperature coefficient measurements accomplished on the SNAP Experiment and Developmental Reactors is presented. Isothermal measurements, transient experiments, and power coefficient measurements are included. Analysis of the experiments resulted in isolation of component effects. The thermal spectrum temperature coefficient for these zirconium hydride moderated systems is shown to be on the order of $-0.04¢/°F$. A new model for the energy transfer process in zirconium hydride is presented which reproduces measured spectra and results in temperature coefficients of the magnitude measured. The calculational model is phenomenologically based and uses Fermi-Dirac statistics to describe the state populations of the protons in the zirconium hydride. (auth)

7561 (NAA-SR-7362) DEVELOPMENT OF THE PYROLYTIC FOULING TEST FOR ORGANIC REACTOR COOLANTS. P. R. Benson (Atomics International. Div.

of North American Aviation, Inc., Canoga Park, Calif.). Nov. 30, 1962. Contract AT-11-1-GEN-8. 34p.

A test was developed for the rapid screening of organic reactor coolants for their film-forming potentials using a pyrolytic fouling apparatus employing a vertical, electrically heated tube in a pool of coolant. Screening experiments using this test showed that pyrolytic fouling of terphenyl mixtures increases with concentration of inorganic materials, concentration of certain organic materials, including oxidation products; and heater surface temperature. Fouling deposits were reduced by removing particulates and nonvolatile or reactive compounds by means of distillation and adsorption, removing particulates by means of filtration and centrifugation, increasing turbulence at the heater surface by boiling, pressurizing with H_2, and using decalin as an additive. The weight of film deposited was not affected by the type of test heater material which included types 321 and 410 stainless steel, Au, and Al. (auth)

7562 (ORNL-3369) MOLTEN-SALT REACTOR PROGRAM. Semiannual Progress Report for Period Ending August 31, 1962. (Oak Ridge National Lab., Tenn.). Dec. 12, 1962. Contract W-7405-eng-26. 156p.

Progress is reported in MSRE design, engineering analysis, component development, metallurgy, in-pile tests, chemistry, fuel processing and in thermophysical properties of salt mixtures. (J.R.D.)

7563 (PRDC-TR-59) MONTHLY TECHNICAL REPORT [ON APDA ACTIVITIES] MAY 1962. (Power Reactor Development Co., Detroit). Contract AT(11-1)-476. 22p.

Research and development progress is reported on fuels and metallurgy, chemistry and materials, engineering analysis, graphite, physics, systems, mechanical design, electric systems and instrumentation, and test operations. (M.C.G.)

7564 (PWAC-89) REACTOR AND SHIELD WEIGHTS FOR THE CFRMR. Charles F. deGanahl (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Dec. 31, 1953. Contract [AT(21-1)-229]. 21p. (FXM-621)

Data are presented on reactor and shield weights for the circulating fuel reflector-moderated aircraft reactor. A brief summary presents assumptions and methods of estimation used. (C.H.)

7565 (PWAC-161) NUCLEAR ENGINEERING PROGRAM. Topical Report No. 1, July 1, 1955—June 30, 1956. (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Contracts AF33(038)-27341 and AT(11-1)-229p. 82p. Fox Project.

Recent engineering progress in the field of nuclear reactor design for aircraft powerplant applications is outlined. Information is divided into three main sections covering circulating fuel reactors; solid fuel reactors, and allied chemistry and metallurgy. (D.E.B.)

7566 (PWAC-170) HAZARDS SUMMARY REPORT ON CRITICAL EXPERIMENT PROGRAM NO. 1 AT CANEL. (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). May 24, 1957. Contract [AT(11-1)-229]. 110p.

The construction of a critical assembly is proposed for determining the characteristics of the PWAC Na-cooled, heterogeneous aircraft reactor design. The experimental facility would be located at the CANEL site. The site meteorology, hydrology, geology, and topography are considered; the facility and critical assembly design is shown, and the extent of hazards from accidents and sabotage is evaluated. (D.E.B.)

7567 (PWAC-186) CORE-MODERATED CIRCULATING FUEL REACTOR STUDY. (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). July 15, 1957. Contract AT(11-1)-229. 254p.

The initial results of a study to determine the feasibility and characteristics of a core-moderated circulating fuel reactor as an aircraft power plant are presented. A preliminary design is described. The reactor consists of three main components: the cylindrical core, the reflector, and the wrap-around heat exchanger. (M.C.G.)

7568 (PWAC-189(Vol.I)) THE P & WA CIRCULATING FUEL REFLECTOR-MODERATED REACTOR. VOLUME I. C. C. Bigelow and M. E. Greenstreet (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). Nov. 15, 1957. Contract AT(11-1)-229. 363p.

The design of a reactor, PWAR-6, intended to be the heat source for a nuclear airplane, is described in detail. The bases for making design choices are given, and, where possible, test results substantiating these choices are shown. Some discussion of operational problems is presented. The reactor is based on the ART circulating-fuel reflector-moderated concept. The ART design was modified for the higher power and the dynamic loads encountered in the aircraft application. The reflector cooling heat-exchanger was located externally to the reactor. Structural details differ because of the higher power and associated higher pressure drops. Spun or forged shells were substituted for flat plates in the upper part of the reactor. The core entrance and core shape differ because hydraulic tests indicated that the ART core entrance did not produce satisfactory fuel flow with one pump inoperative. (M.C.G.)

7569 (PWAC-189(Vol.2)) THE P & WA CIRCULATING FUEL REFLECTOR-MODERATOR REACTOR. VOLUME 2. APPENDIX A: DESIGN SPECIFICATIONS AND REFERENCE INFORMATION FOR THE PWAR-6; FLYING TEST BED APPLICATION. C. C. Bigelow and M. E. Greenstreet, comps. (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). Nov. 15, 1957. Contract AT(11-1)-229. 234p.

Design specifications and reference information for the PWAR-6 are presented. Topics covered include: general specifications, principle dimensions and thicknesses, fuel system, IRT cooling sodium system, main NaK system, branch NaK circuit to heat exchange, shield coolant system, fuel pumps, control rod coolant helium pumps, moderator region, wrap-around fuel-to-NaK heat exchanger, thermal shield, pressure shell, insulation, shielding, reactor and shield support structure, thermal neutron absorbing layers, internal structure, dimensional changes due to thermal expansion, assembly sequence and welded joints, maneuver loads, xenon stripping method and off-gas system, fueling schedule, valves and piping, auxiliary connections to reactor, bearing and seal arrangement and pump drive lubrication, control rod and control rod drive, control, scheduling, instrumentation, ground handling, weight breakdown, reactor materials, physical and mechanical properties of materials, and reactor physics data. (M.C.G.)

7570 (PWAC-206) THE CIRCULATING FUEL REACTOR POWERPLANT CONTROL SYSTEM ANALYSIS. T. A. Flanders and W. A. Blecher (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). [nd]. Contract [AT(11-1)-229]. 68p.

A summary of the analytical work done on the control system of a circulating fuel reactor (CFR) aircraft powerplant is presented. Control configuration and the background which led to the selection of that configuration are discussed. The CFR powerplant consists of one or more circulating fuel reactors which supply heat by a liquid metal system to radiators in otherwise conventional jet engines. The control system must regulate the powerplant safely and efficiently throughout its operating range with any likely combination of nuclear and chemical heat. In addition the controls must be small, lightweight, easy to adjust and to maintain, they must be accurate and reliable and they must be flexible enough in their design to account for minor changes in the powerplant resulting from normal development. The controls must also operate satisfactorily when exposed for long periods to high ambient temperatures and radiation levels. This analysis showed that the powerplant control system can be divided into a reactor control system and an engine control system providing that the nuclear heat added to the engine can be automatically accounted for by the engine control. Separating the control system in this manner simplified the analysis and also the power lever configuration. Different control modes were studied. (auth)

7571 (TID-17402) HIGH TEMPERATURE CLADDING ALLOYS FOR REACTOR APPLICATIONS. John F. Collins and James A. McGurty (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Oct. 19, 1960. Contract [AT(11-1)-171]. 30p.

The development of several metallic fuel element systems for air-cooled reactors is reviewed, and the high-temperature properties of Type 310 stainless steel and Nichrome V clad fuel elements are discussed. Early work on cladding of Mo is reviewed, and recent developments in ferrous-base alloys and Cr-base alloys as high-temperature cladding materials are presented. (auth)

7572 (TRG-Report-306) A SLIDE RULE METHOD OF CALCULATING THE END FITTING TEMPERATURES OF FUEL ELEMENTS. R. Bee (Liverpool. Univ.) and L. R. T. Gardner (United Kingdom Atomic Energy Authority. Reactor Group, Springfields, Lancs, England). June 6, 1962. 15p.

An algebraic expression is derived which expresses the end cap temperature of an idealized fuel element in terms of the can parameters and the uniform mid-can temperature. The problem of determining end-cap temperatures is thus reduced to a graphical/slide rule calculation. The effect upon end-cap temperatures of the variation of certain can parameters is discussed. (auth)

7573 (UCRL-6621) FUEL INSPECTION BY GAMMA COUNTING. Larry Clendenen (California. Univ., Livermore. Lawrence Radiation Lab.). Oct. 16, 1961. Contract W-7405-eng-48. 16p.

After manufacture of the Tory II-A fuel elements they must be separated into the various degrees of loading as required by the core. In order to do this accurately, a system was developed whereby the natural radioactive gamma decay is counted. The amount of uranium in a given sample is proportional to the counts per unit time. A scintillation detector was installed in an automatic loading machine. By setting the upper and lower limits of the detector, the loading of uranium wanted in a fuel element can be selected. The time for sorting each fuel element by this method is 12 sec. (M.C.G.)

7574 (WAPD-T-1225) A NUCLEAR-THERMAL ITERATION ANALYSIS OF A BOILING CORE WITH THE ABRAC, BRIC AND CNCR CODES. J. A. Redfield (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). July 1960. Contract AT(11-1)-Gen-14. 34p.

A test problem is examined in which the boiling water moderator distribution and power distribution are allowed to interact. The Bettis-developed one-, two-, and three-dimensional depletion codes which provide for the moderator variation are used. A comparison of the three-dimensional solution and a synthesized three-dimensional solution is made. Conclusions concerning the limitations and possible advantages with each method are drawn. (auth)

7575 (CEA-tr-A-1125) EVOLUTION DES DÉCHARGES POSITIVES DANS L'AIR JUSQU'AU CLAQUAGE. (Evolution of Positive Discharges in Air up to Breakdown). W. Hermstein. Translated into French from Arch. Elektrotech., 45: 279-88(1960). 34p.

Investigations on phenomena of positive discharge in air have led to new results on the formation of breakdown from discharge of a positive electrode. Various types of positive discharges are treated from the viewpoint of initiation. The results show that positive predischarges have a strong influence on the dielectric properties of the air. The types of predischarge which are most important in the value of the disruptive discharge voltage are the current thread, electric discharge, and beam discharge. The evolution of each of these types is described. (J.S.R.)

7576 THERMAL LOAD LIMITS FOR HOMOGENEOUS AND HETERGENEOUS GRAPHITE FUEL BALLS. E. Knoglinger (Austro-Chematom-Kernbrennstoff-G.m.b.H., Linz/Donau, Ger.). Atompraxis, 8: 414-19(Nov. 1962). (In German)

The temperature and stress distributions in homogeneous and heterogeneous graphite fuel balls are listed. Criteria for thermal load limits are worked out on the basis of the principal stresses and the maximum heat output of the two fuel-element types are compared. (auth)

7577 INVESTIGATIONS ON FISSION-PRODUCT-RETAINING COATED FUEL PARTICLES. P. Koss and H. Bildstein (Reaktorzentrum, Siebersdorf, Austria). Atompraxis, 8: 420-3(Nov. 1962). (In German)

After a short discussion of the specifications and the resulting production methods for fission-product-retaining coated uranium-thorium-dicarbide particles, a survey on testing methods is given which allow an evaluation of the different production methods and of the resulting products. (auth)

7578 DEVELOPMENT IN NUCLEAR TECHNOLOGY. K. Kadlez (Simmering-Graz-Pauker A. G., Vienna). Atompraxis, 8: 440-4(Nov. 1962). (In German)

The first projects undertaken by the Simmering-Gratz-Pauker AG in the nuclear field are described. The fabrication of components and their erection for the ASTRA research reactor provides an opportunity to describe welding problems and the processes by which they were solved. Apart from the manufacture and site erection of its components, the second Austrian research reactor TRIGA MARK-II offered an opportunity to participate in a reactor project from the drawing board to the start-up of the reactor. Emergency power supply units are described as examples of conventional products which were adapted to the special requirements of a reactor. Finally, orders for a nuclear power station in the course of manufacture and the contribution of SGP to the planning of a nuclear power station in Austria are mentioned. (auth)

7579 THE NUCLEAR INDUSTRIES OF THE FORATOM COUNTRIES. E. Busse and F. Flick. Atomwirtschaft, 7: 425(Aug.-Sept. 1962). (In German)

A survey is given of the reactor construction and engi-

neering being done in the FORATOM countries—Germany, France, Belgium, the Netherlands, Austria, Portugal, Switzerland, and Spain. Factors causing the unique development in each country are discussed. A tabulation is given of the reactors in operation and under construction. (J.S.R.)

7580 THE "SPECTRAL SHIFT REACTOR." W. W. Nijs. Atoomenergie Haar Toepassingen, 4: 195-202 (Oct. 1962). (In Dutch)

In the Spectral Shift Reactor, the problem of the control of the excess reactivity was solved by a completely new method. In this type of reactor the largest part of the reactivity control was obtained by a displacement in the neutron spectrum. This was done by addition of heavy water to the light water which was used as moderator and coolant. A description was given of the Babcock and Wilcox project and of the Vulcain project, two reactors of this type. (tr-auth)

7581 PARTIALLY INSERTED BLOCK IN SQUARE LATTICE. L. Trlifaj. Czech. J. Phys., 12: 653-9(1962). (In Czech)

A theory is given of the partially inserted block (control rod) in a reactor of finite height, consisting of a square lattice of fuel blocks and a moderator. The partially inserted block replaces a block of the original lattice, located in the axis of cylindrical symmetry of the reactor. The results obtained agree with the relations for a homogeneous medium, and are thereby justified for homogenized reactors. (auth)

7582 NUCLEAR ENGINEERING IN WESTERN EUROPE. GERMAN INDUSTRY FOR CONSTRUCTION OF REACTORS. K. Diebner. Kerntechnik, 4: 596-603(Dec. 1962). (In German)

7583 KONTROL GERMITICHNOSTI TEPLOVYDELYAYUSHCHIKH ELEMENTOV. (Monitoring Fuel Element Integrity). V. I. Polikarpov, V. S. Filonov, O. V. Chubakova, and N. N. Yuzvuk, Moscow, Publishing House of Literature on Nuclear Science and Techniques, 1962. 187p.

Problems in designing a monitoring system for recording the integrity of heterogeneous reactor fuel rods are discussed. An analysis is made of chemical and physical phenomena affecting the sensitivity and efficiency of a monitoring system. 135 references are included. (R.V.J.)

7584 THE USE OF RESEARCH REACTORS AND SHORT-LIVED ISOTOPES IN THE STUDY OF NUCLEAR REACTOR FUEL MATERIALS. T. S. Elleman, C. W. Townley, and D. N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). IAEA Preprint SM-32/26. 33p. (In English)

To be published in Proceedings of the IAEA Seminar on the Practical Applications of Short-Lived Radioisotopes Produced in Small Research Reactors, Vienna, November 5-9, 1962.

A research reactor may be employed as a useful tool for the study of fission-product mobility in prototype nuclear fuel materials by producing an environment similar to that expected for the normal operation of the fuel material while allowing accurate control of experimental conditions and providing versatility in experimental design. By varying the conditions of irradiation and quantitatively assaying the short half-life fission products released from the specimen, mechanisms of fission-product release may be inferred and related to the physical and chemical properties of the fuel specimen and the fission products. In addition, useful engineering data on gross radioactivity release and expected fuel lifetime may be obtained. Equipment, experimental techniques, and typical results are described. (auth)

7585 IMPROVEMENTS IN OR RELATING TO CHARGE/DISCHARGE SYSTEMS FOR GAS-COOLED NUCLEAR REACTORS. James Lewis Ayre and Peter Raymond Gledhill (to Simon-Carves Ltd. and General Electric Co.). British Patent 911,863. Nov. 28, 1962. Filed Nov. 25, 1959.

A fuel element charge/discharge system for a gas-cooled nuclear reactor allows fuel elements to remain at all times in a gas flow during charging and discharging operations while the reactor is operating. The fuel elements thus present a substantially constant impedance to the gas flow. (R.J.S.)

7586 NUCLEAR POWER INSTALLATIONS. Francis Robert Bell (to De Havilland Engine Co. Ltd.). British Patent 912,208. Dec. 5, 1962. Filed Mar. 17, 1959.

An arrangement is described for nuclear power plants including a reactor and at least one heat exchanger having primary and secondary circuits through which are passed heat-conveying fluids. Pressure-resisting walls about the heat exchangers and the reactor are either integral with or rigidly connected to one another. The heat exchangers are arranged so that their casings tend to shield withdrawn control rods from damage by radiation. (R.J.S.)

7587 NUCLEAR POWER PLANTS. Francis Robert Bell (to De Havilland Engine Co. Ltd.). British Patent 912,209. Dec. 5, 1962. Filed Apr. 13, 1959.

A power plant is described that comprises a nuclear reactor and a heat exchanger which is included in primary and secondary circuits. Fluid in the primary circuit extracts heat from the reactor and transfers it in the heat exchanger to the fluid in the secondary circuit which transmits energy to one or more utilization points. Means are provided for detecting, isolating, and removing radioactive fluid from the secondary circuit. (R.J.S.)

7588 IMPROVEMENTS IN OR RELATING TO ATOMIC REACTORS. Hermann Romer. British Patent 912,335. Dec. 5, 1962. Filed Mar. 20, 1959.

A nuclear reactor using heavy water, either for moderating or cooling, is mounted in a closed chamber having an inlet and outlet by which a gas flow is maintained within the chamber. The gas flow removes substantially all heavy water escaping from the reactor, a heavy water extraction device being connected to the gas outlet. (R.J.S.)

7589 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR REFUELLING MACHINES. Jack Jones (to United Kingdom Atomic Energy Authority). British Patent 912,537. Dec. 12, 1962. Filed Nov. 26, 1959.

A reactor refueling machine is designed to travel across the fueling face of a reactor and connect with a channel extending toward the reactor core. A path is thus defined for the transfer of fuel from the machine to the reactor core. Optical means are provided for sighting the interior of the channel from a point external to the machine. (R.J.S.)

7590 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENT CHARGING AND DISCHARGING ARRANGEMENTS. James Wilfred Ashley, Peter Dean Hodson, Frederick John Rogers, and Maurice William Nichols (to Atomic Power Constructions Ltd.). British Patent 912,659. Dec. 12, 1962. Filed Apr. 17, 1958.

A reactor fuel element in a vertical coolant channel in a reactor core is moved for the purpose of loading or unloading the reactor by a probe entering the bottom of the channel and supporting the fuel element at its lower end. The element is loaded onto and removed from the probe by fuel

element handling means disposed above the reactor core. (R.J.S.)

7591 IMPROVEMENTS IN OR RELATING TO FLUID-COOLED NUCLEAR REACTORS. David John Ingram and George Tolfree (to General Electric Co. Ltd.). British Patent 912,943. Dec. 12, 1962. Filed Oct. 14, 1960.

A liquid-cooled reactor is provided with a number of ducts for the supply and/or exhaust of cooling fluid. The ducts extend through the pressure vessel wall. Each duct is connected with a separate fuel element channel, thereby providing access to the channels for fuel-handling operations. (R.J.S.)

7592 IMPROVEMENTS RELATING TO CONTAINERS FOR USE IN NUCLEAR REACTORS. John Aylward James (to Associated Electrical Industries Ltd.). British Patent 912,966. Dec. 12, 1962. Filed Aug. 12, 1958.

A reactor fuel element container is comprised of Be coated with Cr on its outer surface. Methods are described for depositing the Cr coating. (R.J.S.)

7593 IMPROVEMENTS IN OR RELATING TO SAMPLING APPARATUS FOR OBTAINING GRAPHITE SPECIMENS FROM NUCLEAR REACTORS. William Stephen Cashen and Almond Tinkler (to United Kingdom Atomic Energy Authority). British Patent 914,231. Dec. 28, 1962. Filed Nov. 11, 1959.

The apparatus is comprised of an elongate body of smooth contour and a trepanning head with a cutting face having cutting blades and a parting-off cutter. Means are provided for moving the trepanning head, cutting blades, and parting-off cutter. A coolant is fed into the body and over the cutting blades. (R.J.S.)

7594 UNLOADING DEVICE, PARTICULARLY FOR FUEL ELEMENTS OF NUCLEAR REACTORS. Sebastien Foglia (to Commissariat a l'Energie Atomique). U. S. Patent 3,068,035. "Priority date Feb. 18, 1959, France."

A device is described for removing from a reactor fuel rods, sheaths, or control rods that have undergone such damage as to make it impossible to use conventional unloading means. The device is essentially a heavy cylindrical body provided at the bottom with three vertical fingers, each of which has a recess on its face coming in contact with the element to be removed. A ball or roller located in each recess engages the element when the device is raised. (R.J.S.)

Power Reactors

7595 (ACNP-62018) PATHFINDER ATOMIC POWER PLANT TECHNICAL PROGRESS REPORT, APRIL 1962–JUNE 1962. (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). Oct. 31, 1962. For Northern States Power Co., Minneapolis and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. 36p.

Research and development progress is reported on: fuel material cladding, bonding, and irradiation testing; heat transfer and fluid flow investigations; development of low-enrichment superheater fuel elements; and reactor physics (statics). (M.C.G.)

7596 (ACNP-62574) HAZARDS SUMMARY REPORT FOR CONSTRUCTION AUTHORIZATION OF THE LA CROSSE BOILING-WATER REACTOR. (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). Oct. 1962. Contract AT(11-1)-850. 282p.

The site and main features of the La Crosse Boiling Water Reactor are described. The results of a safety evaluation are presented. The reactor, containment building, power plant, instrumentation and control, electrical distribution, biological shielding, radioactive-waste disposal system, radiation monitoring, environmental survey, and administrative and operational procedures are described. The safety characteristics, evaluation of possible accidents, maximum credible accident, and evacuation procedures are discussed. (M.C.G.)

7597 (DP-785) HEAVY WATER MODERATED POWER REACTORS. Progress Report, September 1962. R. R. Hood and L. Isakoff, comp. (Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.). Oct. 1962. Contract AT(07-2)-1. 23p.

The HWCTR was operated satisfactorily at a maximum power of 24 Mw with driver fuel only in the core for a period of approximately one month prior to the loading of the first test fuel charge. Test irradiations are to start early in October. Precise buckling measurements were made in the PDP and SE on a variety of D_2O-moderated lattices of U and uranium oxide fuel tubes that contained gas, D_2O, H_2O, or organic liquid in the coolant channels. The conditions for manufacturing long brazed closures at the ends of Zircaloy-clad U metal tubes were established at Nuclear Metals, Inc. Preliminary evaluations at SRL indicate that direct extrusion holds promise for the manufacture of satisfactory thin-walled Zircaloy cladding for large-diameter oxide tubes. (auth)

7598 (GA-2566) STATUS OF THE HIGH-TEMPERATURE GAS-COOLED REACTOR. T. G. LeClair (General Atomic Div. General Dynamics Corp, San Diego, Calif.). Sept. 21, 1961. 23p.

The history of gas-cooled reactor development is reviewed. The 40-Mw HTGR for the Peach Bottom Power Plant is described. Other projects to follow this prototype are outlined. Fuel development and progress in graphite core technology are discussed. The program sponsored by the Empire State Atomic Development Associates for a high-temperature gas-cooled reactor with an output of 300 to 500 Mw(e) is described. (M.C.G.)

7599 (GEMP-160) 630A MARITIME NUCLEAR STEAM GENERATOR. Progress Report No. 3. (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). Nov. 30, 1962. Contract AT(40-1)-2847. 89p.

A summary of the progress made on the 630 A Maritime Nuclear Steam Generator is presented. Information is included on propulsion system investigations, reactor design, side shield development, boiler design, containment development, development of controls, development of primary coolant blowers, development of fuel materials, development of nonfuel materials, critical experiments, safety analyses, and development of facilities and equipment. (J.R.D.)

7600 (GNEC-210(Suppl. 1)) DESIGN AND FABRICATION OF THE BONUS REACTOR PRESSURE VESSEL. SUPPLEMENT 1. John F. Gibbons and A. S. Jameson, comps. (General Nuclear Engineering Corp., Dunedin, Fla.). Nov. 1, 1962. Contract AT(40-1)-2674. 513p.

A description of the design, manufacture, inspection, and testing of the Boiling Nuclear Superheater (BONUS) pressure vessel is presented. (J.R.D.)

7601 (GNEC-254) NUCLEAR SUPERHEAT DEVELOPMENT PROGRAM. Thirteenth Quarterly Progress Report, July–September 1962. S. E. Turner, M. F. Valerino, R. S. Harding (General Nuclear Engineering Corp., Dunedin, Fla.); H. V. Lichtenberger, and C. D. Sedlak (Combustion Engineering, Inc., Windsor, Conn.). Oct. 31, 1962. Contract AT(11-1)-795. 204p.

A 42-day test of the NUSU test element at a clad temperature of about 1275°F did not reveal evidence of leaks. Metallographic examination of the clad material is in progress. A compilation of computer programs useful in physics evaluation calculations was completed. A total of 13 codes are now available on a routine basis. Experimental data on the AEC sponsored superheat critical experiments were compiled and cataloged. Calculational procedures used by CEND and GNEC were collected, and the initial application of these methods to selected critical experiments was started. The preliminary design of the annular multitube fuel element was modified, primarily to reduce the stress levels existing near the end seals. The major modifications include a transition piece between the fuel region and the end seals, a larger plenum containing at least a 360° stress-relieving bend of the steam tubes at the top of the element, and an expanded and flared tube-sheet construction. A weld evaluation program was initiated to determine the most suitable procedure for the tube to tube-sheet configuration. (J.R.D.)

7602 (HW-75725) HANFORD STUDIES EXECUTED FOR THE USAEC-AECL COOPERATIVE PROGRAM ON DEVELOPMENT OF HEAVY WATER MODERATED POWER REACTORS. Monthly Progress Report, November 1962. F. W. Albaugh, comp. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 10, 1962. Contract [AT(45-1)-1350]. 7p.

In heat transfer and fluid flow studies, boiling burnout test results are presented obtained in investigations aimed at demonstrating steam generation in a 6.3-ft-long 19-rod bundle section. In other work, fabrication of the dome seal test assembly was initiated. Development of ultrasonic testing methods for fuel sheath tubing is also discussed. (J.R.D.)

7603 (IDO-28560(Vol.I)) ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. FINAL HAZARDS SUMMARY REPORT FOR THE ML-1 NUCLEAR POWER PLANT. (Aerojet-General Nucleonics, San Ramon, Calif.). Nov. 1960. Contract AT(10-1)-880. 272p.

The ML-1 (mobile, low power) plant is to be operated initially at a site within the National Reactor Testing Station. Although an experimental facility is provided at NRTS in support of plant operations, the ML-1 is designed to operate at unprepared sites. The nuclear and mechanical characteristics of the ML-1 are described in order to evaluate the hazards associated with operation, maintenance, and on-site transportation of the power plant. Hazardous conditions that could result from abnormal operation of the power plant or from failure of mechanical equipment are described and analyzed. The maximum credible accident is considered to result from a sudden, large rupture of the primary coolant loop, causing loss of coolant to the atmosphere, with a simultaneous failure of the reactor scram system and subsequent melting of the fuel elements. The resultant hazards, under various conditions including downwind situations, are evaluated. (auth)

7604 (IDO-28560(Vol.II)) ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. FINAL HAZARDS SUMMARY REPORT FOR THE ML-1 NUCLEAR POWER PLANT. SUPPLEMENT I. (Aerojet-General Nucleonics, San Ramon, Calif.). Sept. 1961. Contract AT(10-1)-880. 143p.

A supplement to the ML-1 Hazards Summary Report, No. IDO-28560, originally published in November 1960, is presented. The material in the Supplement amplifies and revises various sections of the original publication, in order to up-date it and to satisfy the requirements pertinent to power operation of the entire ML-1 plant. The text, with illustrations and graphs, is arranged in five sections and two appendixes: (1) a summary that includes an up-to-date tabulation of power plant characteristics; (2) descriptions of significant changes to certain ML-1 components—fuel element, leak-detection and refueling equipment, stainless steel uses, control blade locking mechanisms, and moderator deoxygenation; (3) operation of the plant with air as the coolant; (4) the Phase II Test Program under which the combined reactor and power-conversion packages will be operated; and (5) examples of detailed operating procedures for the test program. The appendixes contain: (1) discussions of recommendations made by the U. S. AEC concerning ML-1 operations, and (2) a list of errata in the original report. (auth)

7605 (MND-M3A-2496-II(Add.)) PM-3A NUCLEAR POWER PLANT HAZARDS SUMMARY REPORT, SAFETY EVALUATION. T. Dobry (Martin Co. Nuclear Div., Baltimore). Nov. 1961. Contract AT(30-1)-2700. 56p.

An evaluation of the potential hazards associated with the operation of the PM-3A Nuclear Power Plant at the Naval Air Facility at McMurdo Sound, Antarctica, under stable weather conditions was performed. A detailed analysis was made of an accident postulating failure of the primary system in which fission products were released to the containment structure, resulting in a continuous leakage of a radioactive plume to a stable atmosphere toward the personnel quarters. The evaluation of this accident indicates that the likelihood of personnel receiving excessive radiation doses is extremely remote. It is concluded that, in an extremely stable environment, the hazards associated with a maximum accident involving the PM-3A Nuclear Power Plant can be controlled by personnel relocation so that the hazard is insignificant. (auth)

7606 (ORNL-1515) AIRCRAFT NUCLEAR PROPULSION PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 10, 1953. W. B. Cottrell, ed. (Oak Ridge National Lab., Tenn.). Apr. 16, 1953. Contract W-7405-eng-26. 179p.

The Aircraft Reactor Experiment No. 1 is described and discussed. Tests of valves, seals, pumps, etc., are described. Preliminary results with an ARE fuel circuit mockup are reported. The following studies on the Aircraft Reactor Experiment No. 2 (reflector-moderated, circulating-fuel reactor) are reported: static physics of the reactor, including the effect on core size and the use of various materials in the core and reflector; the results of critical experiments; mechanical design envisioned and developmental work initiated to provide a basis for the detailed design of a full-scale reactor; and the shielding work to date. Fast neutron removal cross sections were determined for Al, Be, Cu, Fe, LiF, and W. Air scattering experiments in the Bulk Shielding Reactor are described. The time decays of neutrons and gamma rays from the Bulk Shielding Reactor for 0 to 6 hours after shutdown are shown. The status of the Tower Shielding Facility is discussed. Research on fused-fluoride systems concerned with purifying and preparing ARE fuel and fuel carrier is reported. Corrosion characteristics of various fluoride mixtures are discussed. Metallurgy and ceramics research includes: the fabrication of various reactor components for use at high temperatures; creep rupture tests of structural metals; development of special alloys, cermets, and ceramic coatings; and tests of welding and brazing alloys. Control and safety rod inserts for the GE reactor and Tower Shielding Facility are described. Physical property measurements of various fluoride mixtures and heat trans-

fer studies of experimental systems as well as aircraft components are described. Chemical, petrographic, and x-ray diffraction studies of impurities, corrosion products, and constituents of reactor fuels are reported. (L.M.T.)

7607 (ORNL-2752) PRELIMINARY DESIGNS FOR FOUR INTEGRATED GAS-COOLED CERAMIC-FUELED AND -MODERATED REACTOR CORE AND STEAM GENERATOR UNITS. A. P. Fraas (Oak Ridge National Lab., Tenn.). Dec. 12, 1962. Contract W-7405-eng-26. 155p.

Two designs of gas-cooled ceramic-fueled reactors were prepared to see to what extent costs might be reduced by incorporating the reactor core and steam generator in a single pressure vessel and exploiting the high-temperature capabilities of ceramic fuel elements. The first of these designs employed the same basic reactor core and heat exchanger tube matrix as that used in the GCR-Z. The second of the designs made use of a small BeO-moderated core cooled with CO_2 at 1000 psi and an axial-tube steam generator. The results of these studies indicated the desirability of extensive modifications to the layout proposed for the BeO-moderated reactor. Therefore, two additional designs were prepared, one for a BeO-moderated reactor and one for a graphite-moderated reactor, to facilitate a comparison of the two moderating materials applied to the same system configuration. Combining the reactor core and steam generator in a common pressure vessel yielded major reductions in cost. The design of fuel-handling equipment should reduce both the cost of the equipment and the time required for the fuel-handling operations. It was concluded that the plant layout is well-suited to the use of either BeO or graphite and that the capital costs would be much the same. The contamination problem, design precepts, hazards, maintenance, and costs are discussed. (M.C.G.)

7608 (PRDC-TR-60) MONTHLY TECHNICAL REPORT [ON APDA ACTIVITIES FOR] JUNE 1962. (Power Reactor Development Co., Detroit). Contract AT(11-1)-476. 19p.

Emissivity values for borated graphite were found to be 0.83 at 600°F and 0.99 at 1200°F. For A-7 carbon steel emissivity values ranged from 0.5 to approximately 1 and for 304 stainless steel emissivity values ranged from 0.38 to 0.74 in this temperature range. Damage to dummy fuel subassemblies by spalling of the nitrided nozzle sleeves appears to be the result of reactor exposure and fabrication processes. The damage is being examined further. Other work is reported on primary shield tank atmosphere requirements, engineering analysis of Flex-Legs, graphite sampling and testing, physics aspects of shielding and safety, and mechanical design of the primary shield tank and the hold-down assembly. Progress is also reported on development of an ultrasonic core scanner and on control system modifications. A summary of various test operations is included. (J.R.D.)

7609 (SRC-75) HEAVY WATER POWER REACTOR PROGRAM MONTHLY PROGRESS REPORT, NOVEMBER 1962. (Savannah River Operations Office, AEC). 10p.

Research and development activities are reported concerning the AEC-AECL coöperative program, sintered Al products, Zr technology, and heat transfer at low flux. Developmental work associated with operation of the Heavy Water Components Test Reactor is reported along with work on the Carolinas-Virginia Tube Reactor. (J.R.D.)

7610 (SY-5396-R2) SPUR POWER SYSTEM. Quarterly Progress Report for Period Ending September 30, 1962. F. B. Wallace (AiResearch Mfg. Div., Garrett Corp., Phoenix, Ariz.). Oct. 15, 1962. Contract AF33(657)-8954. 199p.

Activities in a program to develop a nuclear-dynamic space power system capable of supplying 300 kw of electric power with a design life of 10,000 hr are reported. The work was accomplished under phase II of the contract which provides for continued analytical and experimental studies in support of the Space Power Unit Reactor. The work is reported in sections on materials testing, bearing development, turbine development, generator development, heat transfer development, control development, and reactor loop component development. (J.R.D.)

7611 (TID-14495) FISSION PRODUCT BEHAVIOR IN DIRECT CONTACT CORE LIQUID METAL FUELED REACTORS. Richard M. Bidwell (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 20p. (LADC-4955)

Chemical behavior of fission products is predicted for a "dynamic core" fast reactor, where the fuel is pumped through an outside loop by the coolant. For a 7.5 at.% Pu–25 at.% Co–67.5 at.% Ce alloy, the various fission products are classified as sodium-extractable, fuel-soluble, precipitating, and rare gases. Evidence predicting behavior of each class is presented. The rates of extraction of removable fission products are estimated for different modes of operation. Extractable fission product atoms are expected to remain in the fuel phase for only a few seconds. The 60% of the fission product atoms remaining in the fuel phase, corresponding to only 35% of the volume, are roughly equal in volume to the Pu consumed. The consumption of the initial inventory of Pu would require the gradual addition of 110% of the original amount of Pu, of which 3% is required to compensate for poisoning. The effective chemical composition of the fuel would be little changed during "100% burn-up." A dynamic core fast reactor can be operated for several years as a continuous chemical system at an economic burn-up rate. (auth)

7612 (TID-14697) PREPARING EBWR FOR HIGH POWER OPERATION. E. A. Wimunc (Argonne National Lab., Ill.). Nov. 1961. Contract W-31-109-eng-38. 17p. (UAC-5783)

Modifications to the EBWR for operation at 100 Mw(t) are described. Preparations before shutting down the reactor, unloading the reactor, opening the piping tunnel, reactor vessel modifications, modifications within the existing facility, and new additions are discussed. A general description of the systems is included. (M.C.G.)

7613 (UNC-5042) TWO-PHASE FLOW PATTERNS WITH HEAT ADDITION. Progress Report for the Period July 1, 1962 through September 30, 1962. S. Israel, M. Crane, and M. Cooper (United Nuclear Corp. Development Div., White Plains, N. Y.). Oct. 15, 1962. Work performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-2876. 38p. (EURAEC-505)

Two-phase flow patterns with heat addition from one wall of a rectangular flow channel are discussed. The ranges of flow rate, steam quality, pressure, and heat flux are typical of power reactors. The first objective is the confirmation of the flow regimes within the operating range of the apparatus. The second objective is the study of the effects of heat addition on the two-phase flow patterns at various levels of surface heat flux, from zero to the critical heat flux. Observation of local flow conditions at the heated surface will aid in developing realistic heat-transfer models. (R.J.S.)

7614 (WAPD-MRP-100) PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD AUGUST 24, 1962 TO OCTOBER 23, 1962. (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Contract AT-11-1-GEN-14. 135p.

All Bettis processing of PWR Core 2 blanket, seed, and poison elements was completed. The production yield through all Bettis operations is 95.6% for blanket elements, 95.9% for seed fuel elements, and 85% for poison elements. There are no major problems in blanket and seed fuel element post-bonding operations at WAFD, and 111 blanket subassemblies were welded to date. The manufacture of the boronated stainless steel poison wafers for PWR Core 2 Seed 1 was completed. The over-all final core B loading of the manufactured poison wafers released for poison element assembly was −0.43% from nominal. The most recent evaluations of the PWR Core 2 thermal performance disclosed a blanket capability significantly in excess of that of the seed, permitting a shift in flow from the blanket to the seed which improved over-all core capability. Core 2 capability was evaluated for core concentrations of Xe other than equilibrium Xe. Improvements in welding equipment have reduced the incidents of defective subassemblies requiring repair. An unacceptable amount of hot tears has been found in one side of one of the four WAFD development subassemblies intended to resolve the poison-clad melting problem. The fabrication of a replacement cluster for PWR Core 1 Seed 4 is essentially complete. The blanket fuel assembly and the reactor general assembly drawings were revised so as to indicate the classification of blanket fuel elements into Type I and Type II categories and to define acceptable core locations for each category. Representative thermocouple terminal box and flux thimble support bracket mock-ups were procured and installed on the full-scale head area mock-up. An evaluation was made of the thermal capability of PWR Core 2 Seed 2 at the beginning of life, which shows that this seed is capable of meeting its design power objective. The Seed 2 burnable poison was located in the subassembly end plates, thereby simplifying fabrication. The contemplated Reactor Protection System set points for PWR Core 1 Seed 4 were established. The set points cover the operation of Seed 4 from initial startup to Group IV rods at 72 in. at conditions of 100% power and equilibrium Xe. A review of the design transients and stresses imposed on the pressurizer surge line nozzle has indicated that the welds of the surge nozzle thermal liner are overstressed. It was recommended that a new thermal liner be installed and that the existing thermal liner be reanchored to the surge line piping in order to eliminate the possibility of this thermal liner moving into the pressurizer should the welds fail. Based upon observations of no increase in Hf^{181} activity levels on components or increase in elemental Hf concentration in circulating crud during Seed 2 life, it is concluded that buildup of Ta by nuclear transformation in the Hf control rods over two seed lives has not presented a Hf corrosion problem. BEWI piping removed from PWR during Seed 2-3 refueling was not effectively decontaminated by the APAC process. This behavior is being investigated further. PWR-1 Seed 3 reached the end of full power equilibrium Xe lifetime after 6935 EFPH of operation. Preparations are in progress to extend core operation at reduced powers. The three-dimensional depletion studies were extended through Seed 3 lifetime using actual control rod positions. Eigenvalues behavior is similar to that observed in the Seed 2 calculations and power sharing calculations were compared with measurements over the first half of Seed 3 life. For the irradiated fuel reactivity experiments, the reactivity perturbation introduced by local heating in an electrical heater of sample geometry (which simulates the β heating of an irradiated fuel sample) is found to behave like a change in thermal weighing functions plus a change in water-volume displacement. A first estimate of Core 2 Seed 2 loading requirement of 470 kg U^{235} was obtained on the basis of a two-dimensional core depletion. This estimate is preliminary and will be used in detail design studies of the self-shielded boron elements. The effect of cladding flow into void space during isostatic pressure bonding on the properties of a PWR Core 2 blanket type fuel element was explored. The results of this investigation revealed that the cladding thickness is reduced as the depth of the defect increases, that the depth of the defect has little or no effect on the pressure deflection characteristics of the Zircaloy diaphragm unless the defect occurs in the area of maximum stress (midway between the compartment ends along the longitudinal rib) and that the limits of acceptability based on the depth of the defect in the fuel element surface are realistic. Testing of the rod control system static inverter prototype revealed an unacceptable oscillation in its output waveform. The unit was returned to the vendor for modification. All technical problems involving rod control panel procurement were resolved and final manufacturing release was granted. (auth)

7615 (WAPD-T-1545) A REVIEW OF MATERIALS IN THE SHIPPINGPORT PRESSURIZED WATER REACTOR. Ronald H. Fillnow (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 5, 1962. Contract AT(11-1)-Gen-14. 25p.

A review is presented of the principal materials of construction employed in the fabrication of the major primary loop components in the Shippingport Pressurized Water Reactor and the basis on which the material selection was made. Fabrication problems attendant to the material choice are identified with resultant actions. The specific problems discussed include fabrication of the large 8-in.-thick reactor vessel, development of acceptable welding techniques on nuclear piping to 18-in. in size, and the operational experience obtained with 17-4 PH stainless steel in the control-rod drive mechanisms. (auth)

7616 POSSIBILITIES FOR THERMAL IMPROVEMENTS IN PRESSURIZED WATER REACTORS. P. Guenther (Siemens-Schuckertwerke, Vienna and Reaktor-Interessengemeinschaft, Vienna). Atompraxis, 8: 438-40(Nov. 1962). (In German)

In spite of their present advanced state of development, pressurized water reactors offer additional potentialities. The efficiency of nuclear power plants with pressurized water reactors can be improved considerably, especially by an increase in the mean power density in the reactor and a further levelling of the neutron-flux distribution. Methods are presented for bringing about these improvements, especially in the field of thermal technology, and the necessary research projects are discussed. (auth)

7617 SPECIAL REQUIREMENTS FOR THE DESIGN AND MANUFACTURE OF NUCLEAR PLANT. P. V. Gilli (Waagner-Biro A. G., Vienna). Atompraxis, 8: 431-8 (Dec. 1962). (In German)

The need for maximum reliability of nuclear plants necessitates special quality requirements. In some countries, design codes for nuclear plants are already existing. Pressure and vacuum vessels for nuclear plants have to be extremely leak tight. Leak rate units and the sensibility of some widely used leak testing methods and instruments are discussed. The necessity of nuclear clean conditions is explained. Nuclear plant components supplied are being

manufactured by the Waagner-Biro AG for the 5 Mw reactor ASTRA of SGAE at Seibersdorf, Austria, for the 28 Bev protonsynchrotron of CERN near Geneva, and for the OECD high-temperature reactor project DRAGOn at Winfrith, England—in particular the steam generators of the DRAGON reactor—are described. (auth)

7618 THE ACCOMPLISHMENTS OF THE ORGANIC REACTOR PROGRAM. A. Pedretti (Comitato Nazionale Energia Nucleare, [Rome]). Comit. Naz. Energia Nucl., Notiziario, 8: No. 4, 12p. (Apr. 1962). (RT/ING (62)7). (In Italian)

The Organic Reactor program is described that is being carried out jointly by C.N.E.N. and private companies. The status of the design work, and the research and development program, are outlined. (auth)

7619 A CONTRIBUTION TO THE OPTIMIZATION OF NUCLEAR POWER STATION PARAMETERS. Jiří Šimonek. Jaderna Energie, 8: 393-400(Nov. 1962). (In Czech)

A method of parameter determination is reported for a nuclear power station from the point of view of the costs of electrical energy produced. The method is approximate and convenient for the choice of nuclear power station parameters in the first phase of design and for combination limitation in detailed optimalization calculations. (auth)

7620 DESIGN PROBLEMS OF CONTAINMENT VESSELS FOR NUCLEAR POWER REACTORS. Th. Jaeger (Kernforschungsanlage des Landes Nordrhein-Westfalen, Jülich, Ger.). Kerntechnik, 4: 492-8(Nov. 1962). (In German)

A survey is made of design problems of containment vessels for nuclear power reactors: Assumption of the maximum credible accident as a basis for design, structural aspects of design, dynamic character of emergency loading and model tests, choice of material and design criteria, requirements and testing of gas-lightness, possibilities of blast loading attenuation. (auth)

7621 POWER REACTORS IN WESTERN EUROPE. R. Boedege (Kernforschungsanlage des Landes Nordrhein-Westfalen, Julich, Ger.). Kerntechnik, 4: 553-61(Dec. 1962). (In German)

A survey is given on the most important types of power reactors, operating or being built. Some thermal reactors are reviewed and those problems different with fast reactors are pointed out. (auth)

7622 HALLAM NUCLEAR POWER FACILITY PROTOTYPE FOR ADVANCED SODIUM-COOLED POWER STATIONS. R. W. Dickinson, R. C. Gerber, and C. L. Larson (North American Aviation, Inc., Canoga Park, Calif.). Power App. Systems, No. 58, 1008-11(Feb. 1962).

The sodium-cooled graphite-moderated nuclear reactor concept is described. The Hallam Nuclear Power Facility (HNPF) for producing superheated steam to generate 75 Mwe net power represents a step toward the ultimate capabilities of this concept. A larger plant design, capable of 360 Mwe gross output, is also presented. The advanced design is expected to produce steam thermodynamically comparable to steam plants that are economically competitive with fossil-fueled stations in many areas of the United States. Two important characteristics of the sodium-cooled reactor concept are the excellent heat transfer properties of liquid sodium and the inherent safety of a low-pressure reactor system. These characteristics are utilized extensively in this concept to minimize total power cost. (auth)

7623 A HIGH PERFORMANCE SODIUM GRAPHITE REACTOR POWER PLANT. R. W. Dickinson (Atomics International, Canoga Park, Calif.). Preprint Paper No. 62-WA-261. New York, The American Society of Mechanical Engineers, 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

A sodium graphite reactor forms the major components of a 525 Mw(e) nuclear power plant, designed for central station use. Unique features of this reactor are its low pressure heat-transfer system, its capability for generating supercritical steam with a net plant efficiency of 43.5 percent, and its unusual safety characteristics stemming from low reactor pressure, chemical compatibility of constituents, and fission product retention. Development is sufficiently advanced so that the plant could be in operation in 1968. (auth)

7624 THE ROLE OF A SUPERHEAT POWER EXPERIMENT IN THE DEVELOPMENT OF SUPERCRITICAL STEAM NUCLEAR-FIRED POWER PLANTS. J. H. Wright, S. N. Tower, and I. M. Keyfitz (Westinghouse Electric Corp., Pittsburgh). Preprint Paper No. 62-WA-345. New York, The American Society of Mechanical Engineers, 1962. 20p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

The current AEC Nuclear Superheat Development Program is based upon the premise that modern steam conditions in direct-cycle nuclear plants will lead to economic nuclear power. The graphite-moderated supercritical once-through pressure-tube reactor (SCOTT-R) appears to fill the foregoing requirements, but there are major development problems in the areas of fuel assemblies, pressure tubes, and corrosion and mass transfer. The Superheat Power Experiment (SPX) is a small (50 Mw) reactor of the SCOTT-R type, designed to provide answers to the SCOTT-R uncertainties. A description of the SPX plant is given together with a research and development program and schedule. The relation of SPX to the Westinghouse Superheat Development Program is discussed. Although SPX is designed to provide sufficient information to confidently build a 300-Mw(e) SCOTT-R prototype plant, an operational research program is indicated to obtain the optimum path with regard to resources, time, and information return. (auth)

7625 SOME NUCLEAR SAFETY CONSIDERATIONS OF THE BONUS REACTOR POWER STATION DESIGN. Frank Bevilacqua (General Nuclear Engineering Corp., Dunedin, Fla.). Preprint Paper No. 62-WA-298. New York, The American Society of Mechanical Engineers, 1962. 28p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

As a requisite to obtaining a license to operate a nuclear power plant, Federal Regulations stipulate that the plant shall be designed such that it does not represent a hazard to the health and safety of the public. A summary of the BONUS plant design is presented as well as details of some of the specific safety problems associated with nuclear plants in general and the BONUS plant in particular. The nuclear safety problems discussed are concerned with the reactor pressure vessel, the superheater fuel, the containment building, and the reactor site. (auth)

7626 CONTAINMENT FOR BOILING WATER REACTORS. R. A. Johnson (Sargent and Lundy, Chicago). Preprint Paper No. 62-WA-306. New York, The American Society of Mechanical Engineers. 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

A technical and economic comparison is presented of

several methods of containment which have been employed or proposed for boiling water reactors. Potential reductions in cost which can be obtained from the use of newer methods of containment are indicated. The acquisition of additional physical data concerning the loading and response of the containment structure to an assumed maximum credible accident will further reduce containment costs. (auth)

Production Reactors

7627 (BAW-1262) SPECTRAL SHIFT CONTROL REACTOR—BASIC PHYSICS PROGRAM. Quarterly Technical Report No. 8, July–September 1962. (Babcock and Wilcox Co. Lynchburg, Va.). Contract AT(30-1)-2602. 111p.

Work performed on the Spectral Shift Control Reactor Basic Physics Program during the eighth contract quarter is summarized. Critical experiments were performed with aluminum-clad 2.46%-enriched UO_2 fuel rods in a lattice having a nonmoderator-to-moderator volume ratio (M/W) of 1.0. Moderator compositions were approximately 0, 50, and 70% D_2O in H_2O. Reported for each of the three cores are the critical size, $d\rho/dh$, buckling and reflector savings, thermal disadvantage factor, and cadmium ratios of U^{235} and U^{238}. Flux distributions across a gap caused by the removal of a row of fuel rods were measured in the 70% D_2O core. Erection and check-out of the Small Lattice Experiment facility were completed, and initial criticality was achieved. Anisotropic scattering coefficients in the BPG code were reviewed. New coefficients, incorporating the latest data for oxygen and deuterium, are tabulated. Two-dimensional calculations for the Small Lattice Experiment are summarized, and preliminary calculations for the next set of critical experiments (2.46%-enriched UO_2, M/W = 0.65) are given. (auth)

7628 (TID-15677) POST STARTUP REACTOR SAFETY. A. A. Johnson (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [Apr. 1962]. Contract AT(07-2)-1. 27p.

The safety practices developed and used in operation of production reactors, primarily the Savannah River production reactors, are described. The organization, training procedures, and administration for the Savannah River Reactor Operation are discussed. The following methods and practices pertinent to safety are described: safety responsibility, communication, reports, information meetings, incident investigations, auditing, and safety studies. (M.C.G.)

7629 RAPSODIE FAST BREEDER REACTOR OF CADARACHE. Comit. Naz. Energia Nucl., Notiziario, 8: No. 6, 8p. (June 1962). (RT/ING(62)8). (In Italian)

The Rapsodie reactor at the Cadarache Nuclear Research Center is France's first plutonium-fueled fast reactor. It uses liquid sodium as a coolant. (auth)

Research Reactors

7630 (ANL-6554) INSTRUMENTED TEMPERATURE-CONTROLLED CAPSULES FOR IRRADIATIONS IN THE CP-5 REACTOR. W. N. Beck and R. J. Fousek (Argonne National Lab., Ill.). Oct. 1962. Contract W-31-109-eng-38. 25p.

Instrumented, temperature-controlled irradiation capsules are being operated in the vertical fuel tubes of the CP-5 test reactor. The fuel tubes were modified in order to divert reactor coolant into the tubes to cool the capsules, and the shield plugs were revised to accommodate the capsule assemblies. Fuel materials and structural materials were successfully irradiated for periods in excess of one year. A description is included of the present capsule and assembly, the method of temperature control and instrumentation, and performance characteristics of the capsules. (auth)

7631 (JAERI-1023) EFFICIENCY TESTING OF THE CONTROL AND COOLING SYSTEMS OF JRR-2. (Japan Atomic Energy Research Inst., Tokyo). 1962. 126p. (In Japanese)

At the end of December 1959 the construction and installment at the JRR-2 site was completed. Subsequently efficiency tests were performed on the control and cooling systems, the results of which are described. (auth)

7632 (JÜL-67-RE) ABSCHIRMUNGSBERECHNUNG FÜR DEN FORSCHUNGSREAKTOR MERLIN. (Shielding Calculations for the MERLIN Research Reactor). O. Schaffer (Kernforschungsanlage, Jülich, Germany). Sept. 1962. 22p.

Dimensions of the reactor, determination of the macroscopic mass-removal cross section for concrete, fast and thermal neutron fluxes and gamma dose rates are discussed. Under very pessimistic assumptions the dose rate at the outer surface of the concrete shielding was calculated to the 0.6548 mrem/hr. Since the permissible tolerance dose rate amounts to 0.75 mrem/hr, it was concluded that the radial shielding of the Merlin is sufficient. (M.C.G.)

7633 (JÜL-73-RE) ERMITTLUNG DER STRAHLENDOSISLEISTUNG AN DER WASSEROBERFLÄCHE IM TANK DES FORSCHUNGSREAKTORS MERLIN. (Determination of the Radiation Dose Rate at the Water Surface in the Tank of the MERLIN Research Reactor). H. Ewertz (Kernforschungsanlage, Jülich, Germany). Oct. 1962. 12p.

Since, at the water surface in the Merlin tank, the share of the total dose rate originating from fast neutrons lies far under 5×10^{-1} mrem/hr and the contribution from the thermal neutrons amount to 1.2×10^{-4} mrem/hr these two shares could be neglected in comparison with the dose rate of 35 mrem/hr caused by gamma radiation. The total dose rate at the water reflector in the tank amounts therefore to a maximum of 35 mrem/hr and originates exclusively from gamma radiation. (tr-auth)

7634 (JÜL-75-RE) NEUTRONENFLUSSMESSUNGEN AM FRJ-1 MERLIN BEI LEISTUNGEN VON 0-40 WATT. (Neutron Flux Measurements in the FRJ-1 MERLIN at Powers from 0 to 40 Watts). H. J. Bormann and W. Porschen (Kernforschungsanlage, Jülich, Germany). Oct. 1962. 44p.

In the first startup phase of the FRJ-1 (Merlin) the relative thermal and epithermal neutron flux distributions were measured with the help of gold probes at outputs between 0 and 40 watt. The absolute flux at a monitor position was determined with manganese foils calibrated in England. The reactor parameters were derived from the flux distribution. Distributions of the thermal and fast neutron fluxes were measured with scintillation and proton-recoil counters and the gamma dose with an ionization chamber. (tr-auth)

7635 (TID-15608) RESEARCH REACTORS. Charles N. Kelber (Argonne National Lab., Ill.). Feb. 1962. Contract [W-31-109-eng-38]. 21p. (UAC-6121)

Four types of research reactors are discussed: training, reactor research, low energy neutron research, and engineering test. The aspects of cost-power, operational

reliability, design rigidity, and ancillary requirements are examined and assigned numerical values. (R.J.S.)

7636 (UCRL-6761) OPERATIONAL PROBLEMS FOR TWO- AND THREE-SHIFT OPERATION OF THE LIVERMORE POOL-TYPE REACTOR. Ernest E. Hill (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 1, 1962. Contract W-7405-eng-48. 28p.

The effect of operating an intermediate-power research reactor on a nonsteady-state schedule is discussed. The magnitudes of the xenon, temperature, and fuel-burn effects on the available excess reactivity are covered for power levels of 1, 2, and 5 Mw, and for various operating schedules including one, two, and three shifts per day. The topics discussed are based on the results of operating experience at the 1- and 2-Mw power levels and calculations for the 5-Mw power level. The xenon-poisoning effects were determined by code calculations (Zorch) normalized to the 1- and 2-Mw observed values. The use of equilibrium xenon poisoning for the determination of total shim-rod worth and core excess reactivity is also covered. For situations not covered by regular schedules, a xenon slide rule was developed to determine the available core excess reactivity at startup. Temperature coefficient effects resulting from the rapid increase in reactor coolant temperature at startup are covered for the specific cooling system characteristics of the LPTR. A fuel cycle program instituted in 1960 is discussed in view of past operational experience. Recent modifications to this fuel cycle program to minimize the excess reactivity swings are presented with the anticipated results. Finally, the over-all effect on available excess reactivity of xenon, temperature, and fuel burn is summarized for intermittent operation of the LPTR at 2- and 5-Mw power levels. (auth)

7637 (JPRS-15345) START-UP OF THE FIRST BELORUSSIAN NUCLEAR REACTOR. V. S. Ermakov. Translated from Inzhener.-Fiz. Zhur., Akad Belorus. S.S.R., 5: No. 8, 138-9(Aug. 1962). 4p.

The nuclear reactor in Belorussia, with a thermal capacity of 2,000 kilowatts, was placed in operation in May 1962. The IRT-2000 research reactor is a heterogeneous reactor of the swimming-pool type. Changes made in the design during construction and assembly are described. (M.C.G.)

7638 NEUTRON FLUCTUATIONS OF THE ULYSSE REACTOR, EXPERIMENTAL RESULTS AND THEIR INTERPRETATION. Augustin Blaquière and Jean Cazemajou (Institut National des Sciences et Techniques Nucleaires, [Paris]). Compt. Rend., 255: 893-5(July 30, 1962). (In French)

The application of the intercorrelation method to the Ulysse reactor permitted the verification of some theoretical result on neutron fluctuation in a reactor. It is revealed, moreover, as a rapid and precise method for the measurement of low reactivity. Finally it appears that in the case of large reactors the method can furnish useful data on local characteristics by systematic exploration of different regions. (tr-auth)

7639 A PULSING REACTOR. Borisas Cimbleris (Comissao Nacional de Energia Nuclear, Brazil). Foton, 2: No. 16, 17, 18, 7-15(Mar.-May 1960). (In Spanish)

A pulsing reactor may be defined as a reactor of periodic criticality, in which pulses of prompt neutrons with a known and fixed energy are produced. The principles of such a reactor, proposed by T. N. Zubariov, are described with emphasis on the hydrodynamic and thermodynamic characteristics. (J.S.R.)

7640 RESEARCH REACTORS IN WESTERN EUROPE. M. Pollermann (Kernforschungsanlage des Landes Nordrhein-Westfalen, Julich, Ger.). Kerntechnik, 4: 541-52(Dec. 1962). (In German)

The numerous application possibilities of research reactors for irradiations, loop experiments and beam tube experiments, a survey of the various reactor types, and their specific properties are discussed. A description is given of the most important Western European research reactors of the following types: natural uranium graphite reactor, natural uranium heavy water reactor, heavy water reactor with enriched uranium, light water reactor with enriched uranium, homogeneous reactor. (auth)

7641 FUEL ELEMENT AND CORE DESIGN OF THE BROOKHAVEN HIGH FLUX BEAM REACTOR. Joseph M. Hendrie (Brookhaven National Lab., Upton, N. Y.). 24p. (BNL-6461)

To be published in TID-7642, Proceedings of the Symposium on Research Reactor Fuel Elements, held September 1962.

Details of the design are presented along with background information on the purpose of the HFBR and on the general arrangement of the system. (J.R.D.)

SPACE APPLICATIONS AND TECHNOLOGY

Refer also to abstracts 6543, 6544, 6545, 6546, 6547, 6548, 6549, 6550, 6551, 6552, 6553, 6556, and 6559.

7642 (AD-276092) SOLAR THERMOELECTRIC GENERATOR SYSTEM CONCEPT AND FEASIBILITY STUDY. Quarterly Report No. 1, February 15, 1962–May 15, 1962. A. J. Krause, J. L. McCabria, and Dale A. Naumer (Westinghouse Electric Corp., Lima, Ohio). May 15, 1962. Contract AF33(657)-8089. 27p.

A sixty inch government surplus searchlight has been modified for use as a collector concentrator. Problem areas related to thermal energy storage have been brought to light. Operating conditions and power output have been defined through mathematical analysis. An increase in the surface area of the radiator has lowered the operating temperature and increased the expected power output. A preliminary system design has been initiated. Component testing and completion of the system design are planned for the next quarter. (auth)

7643 (MND-P-3016-I) SNAP RADIOISOTOPE SPACE PROGRAMS. Quarterly Progress Report No. 8, Task 7, July 1 through September 30, 1961. (Martin Co. Nuclear Div., Baltimore). Contract AT(30-3)-217. 50p.

Activities in a program devoted to the safety evaluation of isotopic power systems in space applications are reported. In the study of upper atmosphere re-entry, flare and telemetry test capsules were completed for scheduled re-entry tests. The altitude of re-entry burn-through for all phase I and II test capsules and nose cone-vehicle-pod relative position data were determined. These data were used in determining the optimum positions and headings for the optical and optical-telemetry aircraft. A 100-lb test pod containing simulated SNAP 3 fuel cores was shot into space in July 1961. Two of these were flare capsules containing Na and K, and one was a telemetry capsule containing a transmitter. The flares were sighted and a telemetry signal was received in this test. The high altitude diffusion and dispersion study was concluded with the writing of equations for turbulence-induced cloud growth, wind-induced translational motion and gravity-induced vertical motion. Results of the program for predicting fuel particle size as a function of initial size and re-entry velocity and altitude are included. Work on the radioisotope shielding code was continued. (J.R.D.)

7644 (NASA-TN-D-1457) AN ELECTRON-BOMBARDMENT ION ROCKET OPERATED WITH ALTERNATING-CURRENT SUPPLIES. Paul D. Reader and Robert C. Finke (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). Dec. 1962. 33p.

Power-supply weight savings and increases in reliability may result from the operation of an electron-bombardment ion rocket on alternating-current supplies instead of on the normal direct current. This approach was investigated with the alternating-current effects determined for 60-cycle sinusoidal wave forms. Results indicate that a compromise system with three of the five necessary supplies operated with alternating current was competitive with total direct-current operation. (auth)

7645 PROBLEMA POLETA PRI POMOSHCHI REAKTIVNYKH APPARATOV; MEZHPLANETNYYE POLETY. SBORNIK STATEY. (The Problem of Flight with the Aid of Reactive Devices; Interplanetary Flights. Collection of Articles). F. A. Tsander. Moscow, Oborongiz, 1961. 459p.

A compilation of articles written by the late F. A. Tsander, containing 7 new articles, in addition to previously published articles, provides an integrated view on the problems in rocketry, and interplanetary travel. The book contains articles on theoretical and practical evaluation of various liquid and metal fuel propulsion reactors and calculations for the DR-1 research reactor. The theory of interplanetary re-entry trajectories, utilization of solar power in space travel, rocket temperature in controlled escape from interplanetary regions and in gravitational field re-entry are discussed as well as electrostatic meteor deflection. (R.V.J.)

7646 BEAM NEUTRALIZATION TESTS OF A FLIGHT MODEL ELECTRON BOMBARDMENT ENGINE. Robert F. Kemp (Space Technology Labs., Canoga Park, Calif.), J. M. Sellen, Jr., and Eugene V. Pawlik. Preprint 2663-62. New York, American Rocket Society, 1962. 37p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

Results are reported from tests under simulated space conditions of beam-neutralizer performance in an electron-bombardment ion propulsion device that uses Hg ions. Beam diagnostics indicate that the neutralizer system is effective, and that the effect of the neutralizing electrons on the beam divergence is negligible. Several neutralizer-cathode configurations are tested, and all yield practically equivalent results. (T.F.H.)

7647 THE EXPERIMENTAL PERFORMANCE OF A CROSSED-FIELD PLASMA ACCELERATOR. V. H. Blackman and R. J. Sunderland (MHD Research, Inc., Newport Beach, Calif.). Preprint 2633-62. New York, American Rocket Society, 1962. 7p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

Experimental results on a steady-state crossed-field accelerator are presented. A study is made of the thrust developed by the accelerator as a function of the various operating parameters, of the lifetime of the components for different accelerator geometries, and of the behavior of the working fluid. Experimental effort is directed toward the solution of material erosion problems. An arrangement is devised that enables high-power tests to be conducted with little erosion of the accelerator components. Power levels up to 60 kw are used in the crossed-field acceleration section with mass flow rates as low as 0.3 gm/sec of argon. Experiments are performed with both confined and open-duct accelerators. A confined duct is operated with several gases, and the relative merits of each of these gases for crossed-field accelerator application is discussed. Empirical relationships for the open-duct accelerator are obtained that describe the thrust as a function of the field parameters and the mass flow rate of the expellant. With the open-duct geometry, thrusts of the order of one pound are achieved with argon at specific impulses greater than 1000 seconds. (auth)

7648 ION PROPULSION FOR THE CONTROL OF STATIONARY SATELLITES. Jerome H. Molitor (Hughes Research Labs., Malibu, Calif.). Preprint 2666-62. New York, American Rocket Society, 1962. 25p. $1.00.

Paper from 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 1962.

One application of electric propulsion may be the attitude control and station keeping of stationary satellites. Major forces (e.g., Earth's triaxiality, solar and lunar attraction, solar pressure, etc.) that tend either to perturb a satellite's orbit or modify its orientation are reviewed. The mission constraints that affect the engine system design, such as velocity increments associated with vernier orbit corrections, required thrusting directions, and the magnitude of disturbance torques, are presented. An evaluation is made of the trade-offs between such critical parameters as attitude and station-keeping accuracy, average power utilization, duty cycle, length of thrusting interval, and satellite mass and moments of inertia. In addition, a design of an ion-engine attitude-control and station-keeping system is given. Such system parameters as power level, thrust level, specific impulse, and weight are specified. (auth)

7649 POWER PLANT CONSIDERATION FOR AN ARC JET SPACE PROPULSION SYSTEM. M. M. Chen, R. R. John, and J. F. Connors (Avco Research and Advanced Development Div., Wilmington, Mass.). Preprint 2553-62. New York, American Rocket Society, 1962. 36p. $1.00.

Paper from Space Power Systems Conference, Sept. 1962, Santa Monica, Calif.

Analytical and experimental results are presented on a comparison of the electrical characteristics and propulsion performance of direct-current and alternating-current arc-jet engines. On the basis of experiments on a hydrogen radiation-cooled arc-jet engine operated on both a-c (1000 to 1500 cps) and d-c power, there appears in terms of propulsion performance to be no clear-cut advantages of single-phase a-c or d-c. Electrically, the d-c arc-jet engine is shown to be more stable than the a-c arc-jet engine in terms of the required ratio of mean operating voltage to open-circuit voltage. Further, in experiments with a radiation-cooled arc-jet engine, it is shown that the engine could stably operate over a wider power range with d-c than with single-phase a-c input power. (auth)

WASTE DISPOSAL AND PROCESSING

7650 (BM-RI-6114) DISPOSAL OF LIQUID WASTE IN THE RESIN-IN-PULP-TYPE URANIUM MILLING FLOWSHEET. Kenneth E. Tame and Joe B. Rosenbaum (Bureau of Mines, Salt Lake City). Apr. 1962. 13p.

Stream and ground water pollution from radioactive nuclides, principally radium-226 and thorium-230, in liquid wastes from U mills can be minimized by reusing the waste solution within the mill. Such reuse of waste solution in an acid leach-resin-in-pulp flowsheet was investigated. The process consists of acid leaching for dissolution of the U, sand-slime separation and countercurrent decantation washing for recovery of a pregnant slime slurry, and the use of ion-exchange resin for recovery of U from the slurry. (R.J.S.)

7651 (HW-74507) PREDISPOSAL TREATMENT OF NPR DECONTAMINATION WASTES. W. N. Koop (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 1, 1962. Contract AT(45-1)-1350. 14p.

Laboratory-scale experiments were conducted primarily to develop predisposal treatment methods for the New Production Reactor wastes accumulated in decontamination operations. A multistep procedure will be used in parts or in all of the primary coolant loop during decontamination. A single-pass procedure will be used in decontaminating the rear face coolant piping. A phosphoric cleaner is being considered along with ammonium citrate solutions. (J.R.D.)

7652 (HW-75290) RESEARCH AND DEVELOPMENT ACTIVITIES. FIXATION OF RADIOACTIVE RESIDUES. Quarterly Progress Report, July–September 1962. E. R. Irish, ed. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 1962. Contract AT(45-1)-1350. 33p.

In calcination and solidification studies, the radiant-heat calciner performed satisfactorily with full-level Purex 1ww feed yielding a dry melted product. Development work on in-tank solidification of bulk salt waste was continued. Studies concerning packaging of radiocesium and radiostrontium were started. In sorption and extraction studies, evaluation of the cation exchange characteristics of commercially available zeolites continued. Several binary systems were studied in detail, and limited studies on a ternary system were made. Experiments were continued in the Micro Pilot Plant (MPP) to improve ion exchange removal of Ru from Purex Tank Farm condensate and to better understand Ru removal so that it can be predicted. Ru appears to be present primarily in the anionic form, but some is present in the cationic form. Although combined treatments of cation and anion exchange efficiently remove Ru, the presence of nitrates and nitrites in the condensate waste reduce the efficiency unless they are also removed. Flowsheets for removal of Cs from Purex wastes were firmed up. These flowsheets are based on the use of both natural and synthetic inorganic ion exchangers. Engineering-scale studies of the loading of Sr on inorganic zeolites for use in fission-product packaging schemes were started. Poor Sr sorption kinetics were observed when $\frac{1}{16}$-in. pellets were used in the packed beds. Further laboratory work was started to study methods of improving the kinetics of the process. (J.R.D.)

7653 (ORNL-TM-396) WASTE TREATMENT AND DISPOSAL PROGRESS REPORT FOR JUNE AND JULY 1962. R. E. Blanco and E. G. Struxness (Oak Ridge National Lab., Tenn.). Dec. 19, 1962. Contract [W-740o-eng-26]. 65p.

The purpose of test R-67 was to test gravity feed to the calciner from a head tank and to try a water cooled Hg trap Test R-67 was not completely successful. The pot overflowed and aluminum nitrate and aluminum oxide filled about half the volume of the Hg trap. The thermocouple for liquid level control didn't sense the high level soon enough. The feed valve for the gravity feed line did not open enough, therefore the pot operated at a low level for the greater part of the filling period. It took 9 hrs of filling to get up to the operating liquid level. The average feed rate was 17.0 liters/hr (391 liters in 23 hrs). The resulting bulk density was 0.50 g/cc. The feeding period was 23 hrs and the calcining time was 24 hrs. The pot was allowed to cool for 6 hrs and then was capped and reheated to measure pressure buildup. After capping the pressure rose to 4 psig in about 1 hr and decayed slowly to atmospheric in about 4 hrs. After 96 hrs at temperature (900°C ± 25°C) an attempt was made to pressurize the pot to about 25 psig to determine if there was a leak. The pot could not be pressurized because the safety rupture disk had ruptured. Sulfate volatility from melts containing 39 wt. % simulated Purex waste oxides was investigated as a function of Na_2O, CaO and P_2O_5 content. All compositions lost some sulfate at 50 to 100°C above the softening point. In general the volatility decreased with increase of either Na_2O or CaO relative to P_2O_5, but no simple correlation was indicated. Softening temperatures were lowered by increase in Na_2O vs CaO. Ceramic solids were obtained but no true glasses. Attempts to produce glasses by addition of varying combinations of Al_2O_3, PbO, BaO, and B_2O_3 to simulated Purex waste plus phosphite were unsuccessful. The use of 0.005 M Na_2CO_3 to precipitate calcium from wastes containing up to 3 ppm of phosphate was demonstrated in four pilot plant runs and produced a decrease in the hardness of the waste leaving the clarifier. An inadvertent Sr^{90} and Cs^{137} breakthrough occurred during one run which was caused by the breakthrough of hardness from a polishing filter. Satisfactory Sr^{90} and Cs^{137} removal to less than 1% of initial concentration were obtained in two runs. The effect of fission product removal on the cost of high-activity waste management was investigated through interim liquid storage, pot calcination, and shipment to salt mines for permanent disposal, and it does not appear that fission product removal will significantly decrease the cost of waste management. Minimum total costs (less costs for disposal in salt) were about 0.141 mill/kwh$_e$ for 99% removal, and 0.147 mill/kwh$_e$ for 90% removal, compared with 0.147 mill/kwh for management of acidic Purex waste from which fission products had not been removed. Test drilling at the site of the proposed large-scale fracturing experiments with actual mixtures of waste and cement has explored all the favorable part of the geologic section from the middle Conasauga to the top of the Knox, and three particularly favorable zones were identified. These are in the lower Conasauga between depths of 692 and 1002 ft, in the upper or middle Chickamauga between 1700 and 1866 ft, and in the lower Chickamauga between 2648 and 2852 ft. Both the array and isolated cylinder tests in the wall and floor of a salt mine were started in July. Operation of the cylinder tests is proceeding normally, but the six peripheral heaters in the array failed due to breakage of the heater lead wires. The cause of the failure is being investigated. Undisturbed cores of

bottom sediments at 14 cross sections on the Clinch River, two cross sections on the Emory River, and two cross sections of Poplar Creek were obtained. Frequency curves for minimum dilution factors of 1-, 3-, 7-, 15-, and 30-day duration were prepared, and it is found that the minimum 30-day dilution factor is 130 for a two-year recurrence interval and is 78 for a ten-year recurrence interval. The minimum dilution factor for a two-year recurrence interval varies from 130 for a 30-day duration to about 20 for a 1-day duration. The capacity of heat-treated gibbsite is approximately 4 meq per 100 g for Cs and 12 meq per 100 g for Sr. The affinity for Sr by the heat-treated material is reflected by the lessened ability of Na ions to desorb the Sr. After the sorbent was leached with Na equal to 23 times the concentration of Cs, 96% of the Cs was desorbed; but when Sr was sorbed, only 77% of the Sr was desorbed after leaching with Na equal to 730 times the concentration of Sr on the sorbent. A sampling train that separates suspended solids directly from creek water is being used to study the transport of suspended solids and their associated activity in White Oak Creek. Results from eight operating runs show that the amount of activity transported downstream by suspended solids is small during low-creek flow rates and/or low-suspended solid loads, but during high stream flow and/or high-suspended-solid loads, significant quantities of Sr, and practically all of the Cs, are associated with sediments; that suspended solids less than 9 μ in size sorb more activity than larger particles; and that considerable variations occur in the concentrations and total amounts of activity associated with the various particle-size groups studied greater than 9 μ in size. The total dissolved hardness in ORNL low-activity waste was reduced to less than 2 ppm by making the water 0.005 M in NaOH and 0.005 M in Na_2CO_3 and using 2 ppm of Fe^{3+} as coagulant; it was reduced to about 3 ppm by making the water 0.004 M in NaOH, 50 ppm in Na_3PO_4, and 7 ppm in Fe^{3+}. Sr in water with such low values of dissolved hardness can readily be removed by factors of 100 to 1000 by foam decontamination. Beaker tests showed that Turco 4234, FAB, sodium hexametaphosphate, and sodium pyrophosphate in only a few parts per million interfere with the precipitation of Ca from 0.01 M NaOH solution. (auth)

7654 DISPOSAL OF RADIOACTIVE WASTES.

G. Strahmer. Kerntechnik, 4: 511-15(Nov. 1962). (In German)

The amount of radioactive wastes from isotope users in the Federal Republic of Germany is rather small. Adequate provisions of the First Radiation Protection Ordinance deal with the waste disposal by the deposition into soil or ordinary wastes, and the discharge into sewers or surface waters. (auth)

CORPORATE AUTHOR INDEX

This index contains entries for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

Each entry under a corporate author is a shortened version of the title of the publication, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt." This change permits a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

A

AEROJET-GENERAL CORP., AZUSA, CALIF.
Prog. rpt. on stress-corrosion cracking of high-strength alloys, 10/62, 17: 6569 (NP-12369)

AEROJET-GENERAL NUCLEONICS, SAN RAMON, CALIF.
Hazards report for ML-1 nuclear power plant, 17: 7603 (IDO-28560 (Vol.I))
Hazards report for ML-1 nuclear power plant, 17: 7604 (IDO-28560 (Vol.II))
Prog. rpt. on hydrazine process development, 8–10/62, 17: 6123 (AGN-AN-756)
Prog. rpt. on Rb/Cs evaluation, 6–9/62, 17: 6635 (AGN-8069)

AERONAUTICAL SYSTEMS DIV. METALS AND CERAMICS LAB., WRIGHT-PATTERSON AFB, OHIO.
Materials research and development program, 17: 6532 (WADC-TR-53-373 (Suppl.9))

AEROSPACE CORP., EL SEGUNDO, CALIF.
Equilibrium of electron beam in plasma, 17: 7424 (DCAS-TDR-62-42)
Instabilities in plasma injected into B_z field, 17: 7428 (NP-12342)
Macroscopic equations of partially ionized gases, 17: 6786 (DCAS-TDR-62-133)
Prog. rpt. on propulsion research, 7–12/61, 17: 7538 (DCAS-TDR-62-44)

AIR FORCE CAMBRIDGE RESEARCH LABS. GEOPHYSICS RESEARCH DIRECTORATE, BEDFORD, MASS.
Bioastronautical measurements of radiation in space, 17: 5765 (AFCRL-62-244)

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
Airborne radiation sampling electrostatic precipitator, 17: 6314 (NP-12386)

AIR FORCE TECHNICAL APPLICATIONS CENTER, WASHINGTON, D. C.
Seismic measurements of Fisher, 17: 6259 (NP-12279)
Seismic measurements of Agouti, 17: 6263 (NP-12283)
Seismic measurements of Antler, 17: 6264 (NP-12284)

AIRESEARCH MFG. DIV., GARRETT CORP., PHOENIX, ARIZ.
Prog. rpt. on SPUR program, 7–9/62, 17: 7610 (SY-5396-R2)

AKADEMIYA NAUK S.S.S.R.
Stability of inhomogeneous plasma, 17: 7436 (NP-tr-928)

AKTIEBOLAGET ATOMENERGI, STOCKHOLM.
Bibliography on determination of radioactive isotopes in urine, 17: 5981 (VDIT-66)
Burnout conditions for flow of boiling H_2O in vertical round ducts, 17: 7528 (AE-87)
Gamma spectrum of Swedish Laplanders, 17: 5763 (AE-80)
Radiation effects in structural materials, 17: 6735 (AE-90)

ALBERT EINSTEIN MEDICAL CENTER, PHILADELPHIA.
Distribution and metabolism of MEG and GED, 17: 5908 (SAN-TDR-62-68)

ALBUQUERQUE OPERATIONS OFFICE, AEC.
Radiological safety at Hardtack, 17: 6317 (OTO-58-3)

ALIGARH MUSLIM UNIV., ALIGARH, INDIA.
Thermal neutron activation cross sections, 17: 7100 (NP-12330(p.95-6))

ALLAHABAD, INDIA. UNIV.
Interaction of 14.8-Mev neutrons with Al, 17: 7093 (NP-12330(p.39-45))
Vibrational spectrum of Na, 17: 7132 (NP-12330(p.399-406))

ALLIS-CHALMERS MFG. CO., MILWAUKEE.
Hazards report for La Crosse BWR, 17: 7596 (ACNP-62574)
Prog. rpt. on Pathfinder, 4–6/62, 17: 7595 (ACNP-62018)

AMERICAN MACHINE AND FOUNDRY CO., NILES, ILL.
Dynamically loaded underground structures, 17: 5666 (AD-274294)

AMES LAB., AMES, IOWA.
Absolute abundance of Cr isotopes in secondary minerals, 17: 6257 (IS-438)
Adsorption of hydrocarbons on clean Ir, 17: 6660 (IS-462)
αZ correction to Bethe-Maximon pair production cross section, 17: 6948 (IS-429)
Application of wax laps to vibratory polishers, 17: 6516 (IS-439)
Electrical properties of tungsten bronzes, 17: 6658 (IS-433)
Electron orbits in magnetic β spectrometer, 17: 6436 (IS-476)
Internal conversion coefficients in Sm-152 and Gd-152, 17: 7079 (IS-272)
Mass spectra of volatile hydrides, 17: 6791 (IS-424)
Pure metals from chemical processes, 17: 6515 (IS-394)
Rare earth lactates, 17: 6039 (IS-445)
Separation of Fe by liquid-liquid extraction, 17: 6183 (IS-423)
Stability and solubility of Ni(II)-*vic*-Dioxime complexes, 17: 6114 (IS-434)
Thorium–Mo phase diagram, 17: 6659 (IS-442)
Vic-Dioximes as analytical reagents, 17: 5954 (IS-431)

ANDHRA UNIV., WALTAIR, INDIA.
Carbon-12 excited states, 17: 7102 (NP-12330(p.104-8))
Pair cross section of γ radiation, 17: 7116 (NP-12330(p.186-92))

ARGONNE NATIONAL LAB., IDAHO FALLS, IDAHO.
Determination of Fe in U–fission element alloys, 17: 5978 (TID-15319)

ARGONNE NATIONAL LAB., ILL.
Acquired radioresistance, 17: 5776 (TID-14698)
ALGOL 60, algebraic common language, 17: 6504 (TID-15527)
Analog computer for quadrupole magnet design, 17: 7346 (TID-17429)
Automatic foil activity counting facility, 17: 6494 (ANL-6628)
Bending-magnet and quadrupole aberrations for paraxial rays, 17: 6782 (ANL-6611)
Capsules for irradiations in reactor, 17: 7630 (ANL-6554)
Catalytic oxidation of graphite, 17: 6679 (TID-15270)
Compton spectrometer, 17: 6438 (TID-15530)
Consecutive ion-molecule reactions, 17: 6781 (ANL-6603(p.57-73))
Cryogenic linacs, 17: 7327 (BNL-6511(p.206-8))
Distortion of atoms in polyatomic systems. II., 17: 6799 (TID-14708)
Effect of x rays on fission rate of Paramecium, 17: 5778 (TID-15521)
Effects of therapeutic removal of Pu, 17: 5706 (TID-14893)

Excited states of light nuclei, 17: 6779 (ANL-6603(p.47-52))
Extraction of Th(IV) as mixed complex, nitrate or chloride, 17: 6189 (TID-15313)
Gamma spectra from capture in neutron resonances, 17: 6776 (ANL-6603 (p.1-8))
Glycerol and oxygen effects on x-ray sensitivity, 17: 5771 (TID-13275)
Intermediate coupling, 17: 7140 (TID-14921)
Ion source developments, 17: 7340 (BNL-6511(p.323-34))
Neutron polarization and differential cross sections, 17: 6777 (ANL-6603(p.9-19))
New techniques in radiography, 17: 5980 (TID-15512)
Nuclear resonance absorption of γ rays, 17: 6778 (ANL-6603(p.20-46))
Phase studies of Pu–C alloys, 17: 6638 (ANL-FGF-343)
Preparation and properties of arc-cast PuC, 17: 6637 (ANL-FGF-321)
Preparing EBWR for high power operation, 17: 7612 (TID-14697)
Prevention of spattering during high-temperature ignitions, 17: 5976 (TID-14592)
Prog. rpt. on physics, 7–8/62, 17: 6775 (ANL-6603)
Pyrene dimers, 17: 5938 (TID-13249)
Radiation-produced defects in doped quartz, 17: 6749 (TID-15542)
Rate of recovery from radiation injury, 17: 5909 (TID-14019)
Research reactor fuel assay, 17: 6473
Research reactors, 17: 7635 (TID-15608)
Solutions of exterior boundary value problems for wave equation, 17: 6503 (TID-14920)
Studies of pickup reactions, 17: 6780 (ANL-6603(p.52-5))
Studies on Ra^{226}, Po^{210} and Th^{228} in bones and teeth, 17: 5705 (TID-14604)
Superconducting linacs, 17: 7326 (BNL-6511(p.204-5))
Swelling of U on postirradiation annealing, 17: 6737 (ANL-6532)
Synergism in solvent extraction of di-, tri- and tetravalent metal ions. V., 17: 6050 (TID-15323)
Synergistic effects in extraction of selected metallic cations, 17: 6188 (TID-15271)
Ternary memory element using tunnel diode, 17: 6501 (TID-14155)
Thermodynamic properties of carbides, 17: 6052 (TID-17413)
Translocation of Th daughters to skeleton, 17: 5707 (TID-15308)
Two-phase, one-component critical flow, 17: 6227 (ANL-6633)
Ultrasonic "jack hammer" developments, 17: 6201 (ANL-FGF-300)
Uranium monosulfide and ThS bodies, 17: 6636 (ANL-FGF-247)
Valence band structure of AgCl, 17: 6053 (TID-17447)
ZGS injector, 17: 7310 (BNL-6511(p.7-18))
ZGS injector vacuum system, 17: 7339 (BNL-6511(p.318-22))

ARKANSAS. UNIV., FAYETTEVILLE.
Prog. rpt. on fallout, 12-31-61, 17: 6272 (ORO-520)

ARMY ENGINEER RESEARCH AND DEVELOPMENT LABS., FORT BELVOIR, VA.
Exo-electron emission, 17: 6789 (ERDL-1704-RR)

ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.
Bioenvironmental features of Ogotoruk Creek Area, Alaska, 17: 6273 (TID-17226)

ATOMIC ENERGY OF CANADA LTD., CHALK RIVER, ONT.
Extending reactor time-to-poison, 17: 7536 (CRIO-1115)
Maximum permissible concentrations of radioactive nuclides in airborne effluents, 17: 6308 (CRER-1098)
Plutonium fuel program in Canada, 17: 6512 (CRRM-1111)

ATOMIC POWER DEVELOPMENT ASSOCIATES, INC., DETROIT.
Evaluation of Blake Na resistivity meter, 17: 6382 (APDA-149)

ATOMICS INTERNATIONAL. DIV. OF NORTH AMERICAN AVIATION, INC., CANOGA PARK, CALIF.
Fouling test for organic reactor coolants, 17: 7561 (NAA-SR-7362)
Oxidation of UC by CO_2, 17: 6665 (NAA-SR-7482)
Rapid O diffusion in BeO, 17: 6666 (NAA-SR-7637)
Temperature coefficients in SNAP reactors, 17: 7560 (NAA-SR-7140)

AUSTRALIA. ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT, LUCAS HEIGHTS, NEW SOUTH WALES.
Effect of neutron irradiation on BeO, 17: 6734 (AAEC/E-99)
High-temperature compatibility of austenitic stainless steel with CO_2, 17: 6560 (AAEC/E-98)
Performance of Schultz-type goniometer, 17: 6380 (AAEC/TM-158)

AVCO CORP. AVCO-EVERETT RESEARCH LAB., EVERETT, MASS.
MHD-supported hypersonic shock layer, 17: 6783 (BSD-TDR-62-337)
Rate of ionization behind shock waves in air. II., 17: 6773 (AFCRL-62-751)

AVCO CORP. RESEARCH AND ADVANCED DEVELOPMENT DIV., WILMINGTON, MASS.
Prog. rpt. on thermodynamics of refractory compounds, 9–11/62, 17: 6045 (RAD-SR-62-251)

B

BABCOCK AND WILCOX CO., LYNCHBURG, VA.
Prog. rpt. on Spectral Shift Control Reactor, 7–9/62, 17: 7627 (BAW-1262)

BATTELLE INSTITUT E. V., FRANKFURT AM MAIN.
Final rpt. on design of plasma electronics measuring device, 4/61–2/62, 17: 7420 (AD-275005)

BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Fission-product-release measurement from clad fuel, 17: 6645 (BMI-1604)
Impurity content determination of U and high-U alloys, 17: 6528 (TID-7625(p.45-51))
In-pile fission gas release apparatus, 17: 6202 (BMI-X-216)
Materials for reactor fuel dissolvers, 17: 6566 (HW-SA-2307)
Prog. rpt. on civilian applications, 8/62, 17: 6511 (BMI-1593(Del.))
Sinterable MgO powders and ceramics, 17: 6590 (ASD-TDR-62-700)
Viscosity of saturated liquid K, 17: 6671 (NP-12366)

BATTELLE MEMORIAL INST. DEFENSE METALS INFORMATION CENTER, COLUMBUS, OHIO.
Defense Metals Information Center accessions, 10/62, 17: 6518 (NP-12288)
Defense Metals Information Center Accessions, 11/62, 17: 6521 (NP-12417)
Prog. rpt. on refractory metals rolling, 17: 6597 (DMIC-176)
Steels for rocket-motor cases, 17: 6651 (DMIC-178)
Thermal radiative properties of materials, 17: 6650 (DMIC-177(Vol.I))

BELL TELEPHONE LABS., MURRAY HILL, N. J.
Vertical velocity computer, 17: 6505 (TID-17315)

BERGEN. UNIVERSITETET.
Finite amplitude instability of positive column, 17: 7423 (D1-82-0211)

BOEING CO., SEATTLE.
Finite amplitude instability of positive column, 17: 7423 (D1-82-0211)

BOSE RESEARCH INST., CALCUTTA.
Directional neutron counter for fast neutrons, 17: 7118 (NP-12330(p.199-201))
Nonelastic scattering of 14-Mev neutrons, 17: 7096 (NP-12330(p.66-70))
Small-angle coherent scattering of γ rays, 17: 7111 (NP-12330(p.158-61))
Total cross sections with 14-Mev neutrons, 17: 7095 (NP-12330(p.61-5))

BRAZIL. INSTITUTO DE ENERGIA ATÔMICA, SÃO PAULO.
Delayed time selector, 17: 6435 (IEA-50)
Determination of Cd in U, 17: 5953 (IEA-48)
Neutron cross sections of Pr, Yb, and Lu, 17: 7078 (IEA-51)
Production of radioisotopes at IEA, 17: 6126 (IEA-49)
Production of U(IV), 17: 6177 (IEA-47)

BRIDGEPORT BRASS CO., CONN.
Mannesmann rotary piercing of U, 17: 6594 (BRB-66)

BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
AGS preinjector beam emittance area and emittance area density distribution, 17: 7342 (BNL-6511(p.338-80))
Anoxic protection of small intestine by intra-arterial catheterization, 17: 5667 (BNL-5798)
Bubble density in hydrogen bubble chamber, 17: 6383 (BNL-5866)
Bunchers, 17: 7331 (BNL-6511(p.261-6))
Chemical and physical behavior of released fission products, 17: 6174
Conference on linear accelerators, Brookhaven Natl. Lab., 8/62, 17: 7308 (BNL-6511)
Determination of C–H ratios by neutron scattering, 17: 5949 (BNL-5814)
Drift tube alignment on AGS linac injector, 17: 7343 (BNL-6511 (p.381-5))
Effect of graphite chemical reactivity on conditions in air-cooled channels, 17: 7534 (BNL-5891)
Electron scattering by molecules, 17: 7076 (BNL-5801)
Energy modulation of Van de Graaff accelerator, 17: 7307 (BNL-5792)
ESR of irradiated quaternary ammonium halides, 17: 6034 (BNL-5559)

Extending range of "Fricke" dosimeter, 17: 6430 (BNL-763)
Fabrication of metal work for radiation experimental cells, 17: 6204 (BNL-5850)
Flux flattening by variation of resonance escape probability, 17: 7533 (BNL-5412)
Formation of hydrazine from radiolysis of ammonia, 17: 6125 (BNL-6016)
Fuel and core design of High Flux Beam Reactor, 17: 7641
Gamma-induced polymerization of α methyl styrene, 17: 6124 (BNL-5838)
Hazards of heavy primary cosmic rays, 17: 6305 (BNL-6501)
Hot cell layout criteria, 17: 6203 (BNL-5820)
Low-velocity traveling waves, 17: 7322 (BNL-6511(p.171-3))
Metabolism of fission products in man, 17: 5699 (BNL-6503)
Neutron diffraction studies of ferroelectrics, 17: 6647 (BNL-5747)
Polarization of protons in Pd–Ni alloy, 17: 6945 (BNL-5648)
Possible deuteron acceleration, 17: 7335 (BNL-6511(p.289-93))
Quantization of baryon number and hypercharge, 17: 6946 (BNL-5726)
Radiation effects on enzymes, 17: 5767 (BNL-5727)
Relation between binding energy and coupling constant, 17: 6943 (BNL-5517)
Single-loop four-point diagrams in $K \to 3\pi$ decay, 17: 6944 (BNL-5528)
Spin density distributions and Hartree-Fock calculations for Fe group series, 17: 6646 (BNL-5674)
Wall and bulk temperatures for fluids flowing in concentric annuli, 17: 6228 (BNL-6177)
Widening Bragg peak in path of charged heavy particles in tissue, 17: 5766 (BNL-5538)

BROOKLYN. POLYTECHNIC INST.
Radiation by uniformly rotating point charge, 17: 6797 (PIBAL-753)

BRUSH BERYLLIUM CO., CLEVELAND.
Helical finned tube development, 17: 6599 (TID-17340)
Prog. rpt. on intermetallic compounds, 7–9/61, 17: 6643 (BBC-112)

BRUSSELS. CENTRE D'ÉTUDE DE L'ÉNERGIE NUCLÉAIRE.
Mosaic structure and its determination, 17: 6644 (BLG-132)

BUREAU OF MINES, RENO, NEV.
Heat of solution of Ce in HCl, 17: 6033 (BM-RI-6146)

BUREAU OF MINES, SALT LAKE CITY.
Liquid waste disposal in U milling, 17: 7650 (BM-RI-6114)

C

CALIFORNIA INST. OF TECH., PASADENA.
Tensile properties of low-alloy and stainless steels, 17: 6661 (JPL-TR-32-222)

CALIFORNIA. UNIV., BERKELEY.
Calibration of Bridgman anvils, 17: 6410 (UCRL-9807)
Elastic scattering of 31-Mev He^3 ions, 17: 7148 (UCRL-9996)

CALIFORNIA. UNIV., BERKELEY. INST. OF ENGINEERING RESEARCH.
Comparison between Anderson's "dynamic" model of fallout and other models, 17: 6307 (CDRP-182-112)
Computations for fall-out, 17: 5749 (CDRP-182-113)
Estimating fallout by regression methods, 17: 6306 (CDRP-182-105)
Fall velocity of fallout particles, 17: 6303 (AD-276121)
Fallout shelter survey, 17: 6302 (AD-276119)
Winds aloft for selected seasons, 17: 6251 (CDRP-182-109)

CALIFORNIA. UNIV., BERKELEY. LAWRENCE RADIATION LAB.
Antiproton-nucleon cross sections, 17: 6959 (UCRL-9288(Rev.))
Beam phase of 88-inch cyclotron, 17: 7349 (UCRL-10070)
Bevatron injector, 17: 7309 (BNL-6511(p.1-6))
Calibration of Bridgman anvils, 17: 6410 (UCRL-9807)
Close-capture adsorption system for radioisotope chemistry, 17: 5942 (UCRL-9659)
Correlation of β^+ annihilation rates in metals, 17: 6960 (UCRL-9793)
Direct observations of heterogeneous precipitation, 17: 6687 (UCRL-10124)
Elastic scattering of 31-Mev He^3 ions, 17: 7148 (UCRL-9996)
Electromagnetic properties of charged vector meson, 17: 6961 (UCRL-9889)
Fabricating liquid-H targets from Mylar, 17: 6808 (UCRL-9824)
Hall probe assembly for cyclotron magnet, 17: 7350 (UCRL-10085)
High-energy reactions of Nb with protons and He ions, 17: 7149 (UCRL-10461)
Hydromagnetic ionizing fronts, 17: 7433 (UCRL-9971)
Ion source mechanism for 88-inch cyclotron, 17: 7348 (UCRL-10068)
Linac focusing, 17: 7333 (BNL-6511(p.274-82))
Mechanical features of r-f system for 88-inch cyclotron, 17: 7347 (UCRL-10065)
Neutron dosimetry with nuclear track emulsion, 17: 6323 (UCRL-9967)
Radiolysis of liquid isobutane, 17: 6134 (UCRL-9924)
Recoil study of $C^{12}(p,pn)C^{11}$, 17: 7147 (UCRL-9911)
Scattering in K=0 band of deformed nuclei, 17: 7146 (UCRL-9764)
Semiconductor transmission-counter system, 17: 6440 (UCRL-10030)
Stepped phase velocity linacs, 17: 7329 (BNL-6511(p.224-34))
Superconductivity tests and studies, 17: 6807 (UCRL-9819)
Thermodynamic stability and bond mechanisms in relation to electronic structure, 17: 6686 (UCRL-10012)
Yield strength of Ag–Al, 17: 6685 (UCRL-9992)

CALIFORNIA. UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Alpha air monitoring with α/β ratio compensation, 17: 6439 (UCRL-5979)
Compressive creep of BeO, 17: 6684 (UCRL-6748)
Diagnostic measurements on P-4 steady-state plasma, 17: 7432 (UCRL-6562)
Distribution of additions in Bi–Cu, Bi–Ag, and Bi–Au, 17: 6683 (UCRL-6452(Pt.II))
Electron spectrum observed on Discoverer satellites, 17: 6917 (UCRL-6792-T)
Fuel inspection by γ counting, 17: 7573 (UCRL-6621)
In situ measurements of elastic properties, 17: 6275 (UCRL-6477)
Internal high-pressure instrumentation problems, 17: 6408 (UCRL-6531)
Ion adsorption on metals, 17: 6803 (UCRL-6389)
Ionization of He and Ar by electron impact, 17: 6805 (UCRL-6702)
Lagrangian and Hamiltonian methods in MHD, 17: 7430 (UCRL-6387)
Lifetimes of excited nuclear states, 17: 6958 (UCRL-7091)
"Protography" with MoO_3, method of H detection, 17: 6409 (UCRL-6793)
Quantized magnetic flux and nature of electrical currents, 17: 6804 (UCRL-6630-T)
Shell model study of Mn-55, 17: 7145 (UCRL-6404)
Steady-state plasma system, 17: 7431 (UCRL-6561)
Thermal decomposition of the rare earth sulfates, 17: 6054 (UCRL-6500)
Thermodynamic functions for H_2O, 17: 6055 (UCRL-7118)
Transport properties of air, 17: 6806 (UCRL-7052)
Two- and three-shift operation of pool-type reactor, 17: 7636 (UCRL-6761)

CALIFORNIA. UNIV., LOS ANGELES.
Occurrence of isotopes in environment, 17: 5755 (UCLA-497)
Radioactive I from nuclear tests, 17: 6322 (UCLA-499)

CALIFORNIA. UNIV., SAN FRANCISCO. SCHOOL OF MEDICINE. RADIOLOGICAL LAB.
Prog. rpt. on radiobiology, 9/30/62, 17: 5779 (UCSF-22)

CANADA. DEFENCE RESEARCH CHEMICAL LABS., OTTAWA.
Models for γ shielding studies, 17: 7497 (DRCL-364)

CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., CHARLOTTE, N. C.
CVTR fuel capsule irradiations, 17: 6739 (CVNA-153)

CENTRAL UTILITIES ATOMIC POWER ASSOCIATES.
Prog. rpt. on Pathfinder, 4–6/62, 17: 7595 (ACNP-62018)

CHANTIERS DE L'ATLANTIQUE PENHOET-LOIRE, PARIS.
Prog. rpt. on welding steel plates, 4–6/62, 17: 6602 (EURAEC-392)

CHICAGO. UNIV. ENRICO FERMI INST. FOR NUCLEAR STUDIES.
Meteorites and early history of solar system, 17: 6902 (EFINS-62-50)

CINCINNATI. UNIV.
Thermal conductivity of graphites, 17: 6640 (ASD-TDR-62-608(Pt.I))

CLEMSON COLL., S. C.
Deterioration of calcia-stabilized ZrO_2, 17: 6667 (NASA-TN-D-1595)

CLEVITE RESEARCH CENTER, CLEVELAND.
Fuel bearing Fiberglas, 17: 6530 (TID-16847)

CLIMAX MOLYBDENUM CO. OF MICHIGAN, DETROIT.
Arc-cast Mo- and W-base alloys, 17: 6672 (NP-12383)

COMBUSTION ENGINEERING, INC., WINDSOR, CONN.
Prog. rpt. on nuclear superheater, 7–9/62, 17: 7601 (GNEC-254)

COMPAGNIE PECHINEY, PARIS.
Prog. rpt. on Zr and alloys, 4–6/62, 17: 6654 (EURAEC-394)

CONTROLS FOR RADIATION, INC., CAMBRIDGE, MASS.
Biological effectiveness of protons and α particles, 17: 5770 (MDC-TDR-62-3)
CORNELL UNIV., ITHACA, N. Y.
Final rpt. on solid surface investigation, 3/1/62, 17: 6634 (AFOSR-2273)
Phonon-defect resonance interaction, 17: 6800 (TID-15495)
CRUCIBLE STEEL CO. OF AMERICA, MIDLAND RESEARCH LAB., PENNA.
Prog. rpt. on manufacturing Nb alloy sheet, 1–9/62, 17: 6593 (ASD-TR-7-784(VII))

D

DELHI. UNIV.
Binding energy of H-3 and n-d scattering lengths, 17: 7089 (NP-12330 (p.15-16))
Neutron inelastic scattering cross sections in Pb isotopes, 17: 7099 (NP-12330(p.86-94))
DENMARK. ATOMENERGIKOMMISSIONEN. FORSØGSINSTITUT, RISØ.
Bibliography on dispersion-strengthened materials, 17: 6677 (RISO-48)
DENVER. UNIV. DENVER RESEARCH INST.
Prog. rpt. on Nb-rich region of ternary phase diagrams, 9/1/62, 17: 6652 (DRI-2057)
Prog. rpt. on oxidation of beryllides, 6–9/62, 17: 6564 (DRI-2056)
Prog. rpt. on oxidation of beryllides, 9–12/62, 17: 6653 (DRI-2071)
DIVISION OF BIOLOGY AND MEDICINE, AEC.
Aeroradioactivity survey and geology of Los Angeles region, 17: 6253 (CEX-59.4.16)
DIVISION OF TECHNICAL INFORMATION EXTENSION, AEC.
Bibliographies of atomic energy literature, 17: 5657 (TID-3714)
DU PONT DE NEMOURS (E. I.) & CO. ATOMIC ENERGY DIV., WILMINGTON, DEL.
Prog. rpt. on heavy water reactors, 9/62, 17: 7597 (DP-785)
DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER LAB., AIKEN, S. C.
Bibliography on determination of T, 17: 6035 (DP-511)
Chloro complexes of nitrosylruthenium, 17: 6051 (TID-15360)
Colorimetry analysis in low parts per billion range, 17: 5977 (TID-15070)
Control of T health hazards, 17: 6309 (DPSPU 62-30-5)
Diffusion coefficient for thermal neutrons in D_2O, 17: 7058 (TID-15165)
Growth of α $Al_2O_3 \cdot H_2O$ corrosion products on Al, 17: 6573 (TID-15280)
Interaction of fissionable units, 17: 6942 (TID-15342)
Leak detector for T, 17: 6390 (DP-198)
Microstructural changes during α-β-α transformation of U, 17: 6680 (TID-15539)
Post startup reactor safety, 17: 7628 (TID-15677)
Preferred orientation measurement in U, 17: 6681 (TID-17492)
Thermal expansion coefficients for rolled U sheet, 17: 6682 (TID-17495)
Zircaloy cladding thickness testers, 17: 6391 (DP-663)

E

EBASCO SERVICES, INC., NEW YORK.
Nuclear port survey, 17: 6312 (NP-12238)
EDGERTON, GERMESHAUSEN AND GRIER, INC., SANTA BARBARA, CALIF.
Galveston area aeroradioactivity survey, 17: 6254 (CEX-62.6.1)
ELECTRO-OPTICAL SYSTEMS, INC., PASADENA, CALIF.
Prog. rpt. on radiation-resistant solar cell, 7/1–10/31/62, 17: 6795 (NP-12317)
Source and detector of radiation in 1500–50 Å region, 17: 6411 (WADD-TR-60-371)
EUROPEAN ATOMIC ENERGY COMMUNITY.
Isotopic composition of samples, from different B standards, 17: 6787 (EANDC(E)-36L)
EUROPEAN COUNCIL FOR NUCLEAR RESEARCH, GENEVA.
Debunchers, 17: 7332 (BNL-6511(p.267-73))
Phase and radial motion in linacs, 17: 7321 (BNL-6511(p.162-70))
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA.
Ceramic spraymat, 17: 6205 (CERN-62-28)
CERN 19-inch chassis systems, 17: 6388 (CERN-62-29)
Design of fast pulse amplifier, 17: 6389 (CERN-62-32)
Determination of best value for primary ionization in track chambers, 17: 6785 (CERN-62-31)
Nanosecond high-voltage pulses for internal cyclotron beam deflection, 17: 7344 (CERN-62-25)
Superconductivity and quantization of magnetic flux, 17: 6784 (CERN-62-30)

F

FLORIDA. UNIV., GAINESVILLE.
Collective motion in beam-plasma system, 17: 7429 (TID-17336)
FORD INSTRUMENT CO., LONG ISLAND CITY, N. Y.
Thermionic plasma, 17: 7419 (AD-274920)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE, PARIS.
Prog. rpt. on Pu recycling, 1–3/62, 17: 6536 (EURAEC-365)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, GRENOBLE.
Balance for measuring magnetic susceptibilities at high or low temperatures, 17: 6385 (CEA-2187)
High stability electrostatic generator, 17: 6384 (CEA-2143)
Prog. rpt. on power of BWR, 3–6/62, 17: 7539 (EURAEC-384)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Activity of γ emitters measured by ionization chambers, 17: 6431 (CEA-2036)
Ammonium diuranate precipitation, 17: 5935 (CEA-2204)
Calorimeter for measurement of in-pile heat evolution, 17: 6386 (CEA-2190)
First excited states of closed shell nuclei, 17: 7088 (NP-12330(p.1-14))
Geochemistry of U–Ra and Th families in Southern Vosges, 17: 6252 (CEA-2154)
Prog. rpt. on forming and irradiation of UC, 1–3/62, 17: 6533 (EURAEC-325)
Statistical pulse generator, 17: 6387 (CEA-2198)
Structure and properties of silica gel, 17: 6648 (CEA-2129)
Study of enriched fuel by means of pulsed neutron source, 17: 7535 (CEA-2201)

G

GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
Evaluation of $(Th,U)C_2$ coated $(Th,U)C_2$ particles, and C coatings, 17: 6655 (GA-3067)
FEVER—program for reactor analysis, 17: 7540 (GA-2749)
Prog. rpt. on chemistry of fission product elements, 8/59–7/60, 17: 6036 (GA-1536)
Status of gas-cooled reactor, 17: 7598 (GA-2566)
GENERAL ELECTRIC CO., EVENDALE, OHIO.
Properties of Mar-Strained steels, 17: 6639 (ASD-TDR-62-230)
GENERAL ELECTRIC CO. AIRCRAFT NUCLEAR PROPULSION DEPT., CINCINNATI.
Cladding alloys for reactor applications, 17: 7571 (TID-17402)
Hydriding procedures, 17: 6649 (DC-61-7-26)
Lithium hydride casting, 17: 6596 (DC-61-7-27)
Preliminary design notes for fuel elements, 17: 7537 (DC-61-4-37)
Production of massive hydrided Zr, 17: 6595 (DC-61-7-18)
Radiation damage to non-metallic materials, 17: 6750 (TID-17382)
GENERAL ELECTRIC CO. AIRCRAFT NUCLEAR PROPULSION PROJECT, EVENDALE, OHIO.
Oxidation protective coatings for W alloy, 17: 6563 (DC-61-7-6)
GENERAL ELECTRIC CO. ATOMIC POWER EQUIPMENT DEPT., SAN JOSE, CALIF.
Prog. rpt. on mass transfer in liquid metal systems, 8/1–8/31/62, 17: 6575 (TID-17384)
Prog. rpt. on mass transfer in liquid metal systems, 9/1/62–9/30/62, 17: 6576 (TID-17386)
GENERAL ELECTRIC CO. FLIGHT PROPULSION LAB. DEPT., CINCINNATI.

Oxidation protective coatings for W alloy, 17: 6563 (DC-61-7-6)
Prog. rpt. on high-temperature materials, 12/14/62, 17: 6741 (GEMP-18A)
Prog. rpt. on maritime nuclear steam generator, 11/30/62, 17: 7599 (GEMP-160)
Prog. rpt. on reactor instrumentation and control, 11-30-62, 17: 7542 (GEMP-75)

GENERAL ELECTRIC CO. HANFORD ATOMIC PRODUCTS OPERATION, RICHLAND, WASH.

Accumulation of radionuclides by aquatic insects, 17: 5702 (HW-SA-2848)
Analog computer applications in chemical engineering, 17: 5936 (HW-SA-2815)
Analog computers in nuclear processes, 17: 6496 (HW-SA-2552)
Analysis of Np, 17: 6025
Analytical studies and advanced concepts, 17: 7551 (HW-74761(p.7.1-28))
Antibiotic resistance and radiation induced mutation in *C. columnaris*, 17: 5769 (HW-SA-2540)
Application of external energy absorbers to large fission product shipping casks, 17: 6362
Cation and anion effects on distribution of U, 17: 6037 (HW-SA-2537)
Ceramic U fuel, 17: 7548 (HW-74761(p.4.1-47))
Cesium-137 in dried milk products, 17: 5752 (HW-SA-2337)
Chemical research, 17: 7550 (HW-74761(p.6.1-20))
Collision probabilities in spheres, 17: 7056 (HW-SA-2696)
Corrosion in nuclear reactors, 17: 6567 (HW-SA-2745)
Deformation of shaped cylindrical fuel elements, 17: 7543 (HW-70501)
Development of reactor safety standards, 17: 7557 (HW-SA-2507)
Distortion of helical wire wrappings, 17: 6743 (HW-SA-2445)
Effect of chronic feeding of Sr^{90}–Y^{90}, 17: 5701 (HW-SA-2255)
Electrical properties of ZrO_2 corrosion films, 17: 6656 (HW-75501)
Electrolytic growth of UO_3, 17: 6514 (HW-74784)
Electron microscopy laboratory, 17: 6657 (HW-SA-2550)
EURATOM PuO_2–UO_2 test elements, 17: 7544 (HW-71232)
Fission product casks and containers, 17: 6244 (HW-SA-2807)
Fission-product confinement program, 17: 6311 (HW-SA-2843)
Fuel element contamination tester, 17: 6434 (HW-73155)
Gas-cooled reactor studies, 17: 7554 (HW-74761(p.10.1-6))
Growth of cells exposed to internal beta irradiation, 17: 5773 (TID-13613)
Input and source impedance corrections in voltmeter standardization, 17: 6395 (HW-SA-2510)
Instrumentation and nondestructive testing, 17: 7555 (HW-74761(p.11.1-14))
Irradiation effects on materials, 17: 7553 (HW-74761(p.9.1-37))
Irradiation of UO_2–PuO_2 capsules, 17: 6745 (HW-SA-2675)
Irradiation testing of UO_2–PuO_2 PRTR fuel elements, 17: 6744 (HW-SA-2668)
Lake storage lowering of river temperatures, 17: 6255 (HW-SA-2301)
Material balance information use, 17: 5665
Materials development, corrosion, and heat transfer studies, 17: 7552 (HW-74761(p.8.1-15))
Materials for reactor fuel dissolvers, 17: 6566 (HW-SA-2307)
Measurement of permeability in heterogeneous media. III., 17: 6790 (HW-SA-2405)
Measurements on Phoenix fuel standards, 17: 5951 (HW-74796)
Movement of fission fragments and Pu in UO_2 irradiation tests, 17: 6742 (HW-SA-2309)
Multidimensional partially saturated flow in soils, 17: 6256 (HW-SA-2854)
Neutron rethermalization in graphite and H_2O, 17: 7055 (HW-SA-2415)
Optimizing programming effort through machine processing, 17: 5654 (HW-SA-2502)
Physics, 17: 7549 (HW-74761(p.5.1-35))
Phytosociological analyses following atomic explosions, 17: 5655 (HW-SA-2546)
Plutonium fuels, 17: 7547 (HW-74761(p.3.1-39))
Plutonium Recycle Test Reactor, 17: 7556 (HW-74761(p.12.1-5))
Plutonium value in fast oxide breeder, 17: 7545 (HW-72304)
Polarograph for controlled potential polarography, 17: 6393 (HW-SA-2300)
Predisposal treatment of NPR decontamination wastes, 17: 7651 (HW-74507)
Prog. rpt. on fixation of radioactive residues, 7–9/62, 17: 7652 (HW-75290)
Prog. rpt. on heavy water reactors, 11/62, 17: 7602 (HW-75725)
Prog. rpt. on reactor development, 4–6/62, 17: 7546 (HW-74761)
Radiation monitor and analyzer, 17: 6433 (HW-71354)
Rates of thermal polymerization of polyphenyl compounds, 17: 6113 (HW-SA-2414)
Reactor physics of Pu in H_2O, 17: 7558 (HW-SA-2529)
Removal of radioisotopes from Columbia River, 17: 6310 (HW-SA-2411)
Reproductive performance of swine ingesting Sr-90, 17: 5700 (HW-74969)
Telemetering installation to report Columbia River data by radio, 17: 6394 (HW-SA-2481)
Thyroid adenomas in sheep fed I-131, 17: 5768 (HW-SA-2493)
Transistorized count-rate-meter, 17: 6432 (HW-66899)
Ultrasonic inspection of thick wall steel pipe, 17: 6243 (HW-74597)

GENERAL ELECTRIC CO. MISSILE AND SPACE VEHICLE DEPT., BURLINGTON, VT.

High-temperature remotely handleable cabling system, 17: 6208 (XDC-61-3-66)

GENERAL ELECTRIC CO. RESEARCH LAB., SCHENECTADY, N. Y.

Radiation damage in metals, 17: 6732 (62-GC-207)
Radiation damage in metals, 17: 6733 (62-GC-209)
Small bakeable mass spectrometer, 17: 6379 (61-RL-2501G(Rev.))

GENERAL ELECTRIC CO. VALLECITOS ATOMIC LAB., SAN JOSE, CALIF.

Power cycling of high-power-density fuel specimens, 17: 6513 (GEAP-4069)
Prog. rpt. on pulsed neutron application to reactor startup, 17: 7541 (GEAP-4047)

GENERAL MOTORS CORP. ALLISON DIV., INDIANAPOLIS.

Prog. rpt. on thermionic emitter, 2–5/62, 17: 6788 (EDR-2791)

GENERAL NUCLEAR ENGINEERING CORP., DUNEDIN, FLA.

BONUS reactor pressure vessel, 17: 7600 (GNEC-210(Suppl.1))
Prog. rpt. on nuclear superheater, 7–9/62, 17: 7601 (GNEC-254)

GEOLOGICAL SURVEY, WASHINGTON, D. C.

Aeroradioactivity survey and geology of Los Angeles region, 17: 6253 (CEX-59.4.16)

GEORGIA INST. OF TECH., ATLANTA. ENGINEERING EXPERIMENT STATION.

Prog. rpt. on polymers, 6/62–8/62, 17: 5941 (TID-17239)

GEOTECHNICAL CORP., GARLAND, TEX.

Seismic measurements of Hyrax, 17: 6269 (NP-12420)

GHENT. RIJKSUNIVERSITEIT.

Prog. rpt. on stainless platings of steels, 1–3/62, 17: 6534 (EURAEC-329)
Prog. rpt. on stainless platings on steels, 4–6/62, 17: 6537 (EURAEC-377)

GOODYEAR ATOMIC CORP., PIKETON, OHIO.

Titrimetric determination of U, 17: 5950 (GAT-471)

GOODYEAR ATOMIC CORP., PORTSMOUTH, OHIO.

Modifications of cylindrical powder diffraction camera, 17: 6392 (GAT-T-973)

GT. BRIT. NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE, HARWELL, BERKS, ENGLAND.

Beam observations in P.L.A., 17: 7330 (BNL-6511(p.235-60))
Long iris-loaded linacs, 17: 7323 (BNL-6511(p.174-83))
Nimrod injector, 17: 7312 (BNL-6511(p.38-49))
P.L.A. of Rutherford Laboratory, 17: 7311 (BNL-6511(p.19-37))
Superconducting linacs, 17: 7324 (BNL-6511(p.184-95))

GRENOBLE, FRANCE. UNIVERSITÉ.

High stability electrostatic generator, 17: 6384 (CEA-2143)

H

HAHN-MEITNER-INSTITUT FÜR KERNFORSCHUNG BERLIN.

Radiation reaction of polyvinylacetate in solution, 17: 6127 (NP-12303)

HARVARD UNIV., BOSTON.

Prog. rpt. on tissue transplantation, 6/61–5/62, 17: 5762 (AD-276039)

HARVARD UNIV., CAMBRIDGE, MASS.

Goldstone expansion corrections, 17: 6497 (NP-12304)

HEBREW UNIV., JERUSALEM.
Charge-transfer complexes of I, 17: 6038 (IA-763)

HOLMES AND NARVER, INC., LOS ANGELES.
Radiological safety at Hardtack, 17: 6317 (OTO-58-3)

I

ILLINOIS INST. OF TECH., CHICAGO.
Chemical thermodynamics of materials at high temperature, 17: 6043 (NP-12310)
Electronic entropy in liquid metal solutions, 17: 6044 (NP-12311)

ILLINOIS INST. OF TECH., CHICAGO. ARMOUR RESEARCH FOUNDATION.
Metallography of Nb–O and Nb–C alloys, 17: 6525 (TID-7625(p.8-19))
Prog. rpt. on airborne particles, 10/1–12/1/62, 17: 6304 (ARF-3187-10)
Prog. rpt. on coating-metal bonds, 7–9/62, 17: 6509 (ARF-1213-5)
Prog. rpt. on coatings for V-base alloys, 9/15/62–11/12/62, 17: 6562 (ARF-B-6001-1)
Prog. rpt. on reactor containment, 9–10/62, 17: 7532 (ARF-K6018-3)
Prog. rpt. on Zr alloys, 7/1/62–9/30/62, 17: 6561 (ARF-2198-34)
Radiation effects on semiconductor catalysts, 17: 6738 (ASD-TDR-62-233)
Structure in Zr–Fe–Sn system, 17: 6527 (TID-7625(p.30-41))

ILLINOIS. UNIV., URBANA.
Circuits for pattern articulation unit, 17: 6506 (TID-17350)
Description of transfer memory, 17: 6498 (NP-12307)
Operation of 3-bit bubbling register, 17: 6499 (NP-12308)

INDIA. ATOMIC ENERGY ESTABLISHMENT, TROMBAY.
Alpha spectra using solid state detectors, 17: 7119 (NP-12330(p.202-8))
Angular correlations of fission fragments in U-235, 17: 7098 (NP-12330 (p.79-85))
Annealing radiation damage of (n,γ) and (γ,n) reactions, 17: 7134 (NP-12330(p.415-21))
Annealing radiation damage of (n,γ) reaction, 17: 7135 (NP-12330 (p.422-8))
Concentration studies in plastic scintillators, 17: 7122 (NP-12330 (p.220-3))
Dynamic polarization of nuclei using magnetic resonance, 17: 7123 (NP-12330(p.224-41))
Energy distribution of thermal neutrons in Be, 17: 7129 (NP-12330 (p.378-83))
First forbidden β spectra of Nd-147, 17: 7113 (NP-12330(p.166-71))
Inelastic scattering of cold neutrons in BeO, 17: 7130 (NP-12330(p.384-91))
Life time of first excited state of Sn-116, 17: 7110 (NP-12330(p.152-7))
Multiplication constants of BeO–U lattices, 17: 7131 (NP-12330 (p.392-8))
Neutron cross sections at thermal and subthermal energy, 17: 7128 (NP-12330(p.369-77))
Nuclear recoil following radiative capture of neutrons by Co-59, 17: 7133 (NP-12330(p.407-14))
Radiation damage in calcite, 17: 7136 (NP-12330(p.429-31))

INDIA. DEPT. OF ATOMIC ENERGY. PHYSICS ADVISORY COMMITTEE, BOMBAY.
Proceedings of nuclear physics symposium, Madras, 1962, 17: 7087 (NP-12330)

INDIAN INST. OF SCIENCE, BANGALORE.
Single-channel pulse-height analyzer, 17: 7120 (NP-12330(p.209-13))

INDIAN INST. OF TECH., KHARAGPUR.
NMR spectra of A_2B_2X system, 17: 7124 (NP-12330(p.242-8))

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.
Conference on corrosion of reactor materials, Salzburg, 6/62, 17: 6583
Symposium on thermodynamics of nuclear materials, 17: 6104

ISOTOPES, INC., WESTWOOD, N. J.
Prog. rpt. on high-altitude sampling program, 12/1/62, 17: 6271 (NYO-10464)

ISRAEL. ATOMIC ENERGY COMMISSION, REHOVOTH.
Anion exchange of metal complexes. X., 17: 6181 (IA-780)
Anion exchange of metal complexes. XIII., 17: 6182 (IA-783)
Charge-transfer complexes of I, 17: 6038 (IA-763)
Protonium two-meson annihilation, 17: 6947 (IA-768)
Separation of metals by focusing ion exchange, 17: 6180 (IA-769)
Separation of precipitates using adhesion on glass, 17: 5952 (IA-772)
Solvent extraction of inorganic species, 17: 6179 (IA-740)

ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, BOLOGNA.
POLLY—one group Fermi age, 17: 6495 (CNEN-140)

ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE. LABORATORI NAZIONALI, FRASCATI.
Form factors of K_{e3} decay and kaon production, 17: 6953 (LNF-62/89)
Spin correlation in muon pair production, 17: 6952 (LNF-62/75)
Tunnel diode fast discriminator circuit, 17: 6399 (LNF-62/73)

ITALY. ISTITUTO SUPERIORE DI SANITÀ, ROME.
Prog. rpt. on research, 3/31/62, 17: 6792 (ISS 62/14)

J

JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.
Testing of control and cooling systems of JRR-2, 17: 7631 (JAERI-1023)

JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Absorption of π^- mesons in hydrogenous substances, 17: 7083 (JINR-P-1081)
Amplitudes of nucleon-nucleon scattering, 17: 7080 (JINR-P-1024)
Causality in present field theory, 17: 6793 (JINR-P-1090)
Determining proton emission by nuclei, 17: 7082 (JINR-P-1072)
Elastic scattering of protons by carbon nuclei, 17: 7081 (JINR-P-1025)
Polarization correlation C_{nn} and scattering amplitude moduli for pp scattering, 17: 6949 (JINR-D-1073)
Propagation of signal inside elementary particle, 17: 6951 (JINR-P-1091)

K

KERNFORSCHUNGSANLAGE, JÜLICH, GERMANY.
Collector system for condenser banks of high-energy content, 17: 6397 (JUL-72-PP)
Construction of condenser banks with low inductivity and high energy content, 17: 6396 (JUL-71-PP)
Critical masses for core arrangements in FRJ-1 Merlin, 17: 7559 (JUL-76-RE)
Neutron flux measurements in FRJ-1 Merlin, 17: 7634 (JUL-75-RE)
Practical neutron dosimetry, 17: 6437 (JUL-69-ST)
Preparation and properties of cyano complexes of four- and five-valent Tc, 17: 6040 (JUL-68-RC)
Radiation dose rate at water surface in Merlin reactor, 17: 7633 (JUL-73-RE)
Shielding calculations for Merlin reactor, 17: 7632 (JUL-67-RE)
Spectrophotometric studies of uranyl ion system, 17: 5955 (JUL-74-PC)

KERNFORSCHUNGSZENTRUM, KARLSRUHE, GERMANY.
Request for $\sigma_{n,f}$ (Pu 240) measurements, 17: 7077 (EANDC(E)-37L)

KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
Determining source of nuclear system pipe wall radiation, 17: 6574 (TID-15281)
Low-energy γ rays in Xe-131, 17: 7142 (TID-15548)
Multidimensional neutron group diffusion computations, 17: 7057 (TID-14262)
Preparation of BC, Zy-2 samples, 17: 6526 (TID-7625(p.20-9))

L

LIBRARY OF CONGRESS. AIR INFORMATION DIV., WASHINGTON, D. C.
Nuclear instrumentation and control for propulsion, 17: 6381 (AD-254402)

LIVERPOOL. UNIV.
End-fitting temperatures of fuel elements, 17: 7572 (TRG-Report-306)

LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Anion-exchange separation of Pu and Th, 17: 6187 (TID-14598)
Arm counter in blood clearance studies, 17: 5677 (TID-14613)
Body Na-24 activity as measure of body dose, 17: 5775 (TID-14529)
Bond lengths in solid He, 17: 6046 (TID-13145)
Cellular radiobiology, 17: 5674 (LAMS-2780(p.211-45))
Clinical investigations, 17: 5673 (LAMS-2780(p.181-210))
Comparative resistance of mice to low intensity γ irradiation, 17: 5777 (TID-15181)

Crystallographic data, 17: 6116 (TID-14533)
Decay of fission product Sn and Sb isotopes, 17: 7139 (TID-14799)
Direct comparison of B-12 and N-12 β spectra, 17: 7141 (TID-15182)
Extrapolation procedure for linear systems, 17: 6502 (TID-14532)
Ferroelectric solid solutions possessing relatively large spontaneous polarizations, 17: 6678 (TID-14508)
Fission product in liquid metal fueled reactors, 17: 7611 (TID-14495)
Fluid dynamics calculation, 17: 6230 (TID-14550)
Godiva II critical assembly, 17: 5774 (TID-13984)
Hafnium cross sections and temperature dependence, 17: 7084 (LA-2763)
Heat capacity of PuO_2 below 320°K, 17: 6049 (TID-15183)
Isotope effect in recombination of I atoms, 17: 6041 (LAMS-2781)
Low-level counting, 17: 5672 (LAMS-2780(p.130-80))
Mammalian metabolism, 17: 5670 (LAMS-2780(p.17-84))
Mammalian radiobiology, 17: 5671 (LAMS-2780(p.85-129))
Molecular radiobiology, 17: 5675 (LAMS-2780(p.246-317))
Prog. rpt. on biological and medical research, 7/61–6/62, 17: 5669 (LAMS-2780)
Reflecting microscope for temperatures to above 2500°C, 17: 6406 (TID-13148)
Thermal expansion of PuC and PuC–UC, 17: 6662 (LA-2768)
Thermodynamics of $PuCl_4$, 17: 6048 (TID-14538)
Valences of Ce allotropes, 17: 6047 (TID-14535)

LUCKNOW, INDIA. UNIV.
Scattering of EM radiation by free electrons, 17: 7114 (NP-12330 (p.172-8))

M

MAHAKOSHAL MAHAVIDYALAYA, JUBBULPORE, INDIA.
Absolute electron-electron scattering cross section, 17: 7117 (NP-12330 (p.193-8))

MALLINCKRODT CHEMICAL WORKS. URANIUM DIV., WELDON SPRING, MO.
Mannesmann rotary piercing of U, 17: 6594 (BRB-66)

MARTIN-MARIETTA CORP. AEROSPACE DIV., BALTIMORE.
Hazards rpt. on PM-3A, 17: 7605 (MND-M3A-2496-II(Add.))
Prog. rpt. on SNAP program, 7–9/61, 17: 7643 (MND-P-3016-I)
Stabilized and hydration-resistant Eu_2O_3, 17: 6664 (MND-M-2346)

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Chemical consequences of β decay of Ce, 17: 6131 (TID-13363)
Equilibrium H_2O content of ion exchange resins, 17: 5939 (TID-13384)
Meridional circulation in stratosphere during IGY, 17: 6274 (TID-17467)
Polarization of ligand-field spectra of planar chelate complexes, 17: 6115 (NYO-9868)
Prog. rpt. on electronics, 6–8/62, 17: 6801 (TID-17303)
Prog. rpt. on isotopic abundances, 1962, 17: 6270 (NYO-10325)
Rotational motion in a many-particle system, 17: 6956 (TID-13705)
Strengthening mechanisms of dispersion-strengthened alloys, 17: 6591 (ASD-TDR-62-734)

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. LAB. FOR NUCLEAR SCIENCE.
Rotational motion in a many-particle system, 17: 6956 (TID-13705)

MAX-PLANCK-INSTITUT FÜR CHEMIE, MAINZ.
Prog. rpt. on T determination, 11/60–10/61, 17: 5947 (AFCRL-62-295)

MAX-PLANCK-INSTITUT FÜR PHYSIK UND ASTROPHYSIK, MUNICH.
Sputtering of solids, 17: 6813 (NP-tr-930)

MELLON INST., PITTSBURGH.
Photolysis and radiolysis of iodoethane, 17: 6130 (RRL-78T)

METALLGESELLSCHAFT A. G., FRANKFURT AM MAIN.
Constitution of Zr–Nb–Sn alloys with high Zr content, 17: 6697 (EURAEC-358)
Effect of H on Zr alloys with Nb and Sn, 17: 6696 (EURAEC-353)
Zirconium alloys with Nb and Sn as canning material, 17: 6535 (EURAEC-352)
Zirconium alloys with Nb and Sn as sheathing material, 17: 6600 (EURAEC-354)

MICHIGAN. UNIV., ANN ARBOR.
Handling and separation of short-lived radioisotopes, 17: 6133 (TID-17337)
Hardness of irradiated and non-irradiated diamond, 17: 6751 (TID-17406)
Prog. rpt. on nuclear chemistry, 11/61–10/62, 17: 6132 (TID-17272)
Thermodynamic measurements using optical absorption in metal vapors, 17: 6802 (TID-17348)

MICHIGAN. UNIV., ANN ARBOR. VELA SEISMIC INFORMATION ANALYSIS CENTER.
Colloquium on detection of underground nuclear explosions, 17: 6265 (NP-12297)

MICROWAVE ASSOCIATES, INC., BURLINGTON, MASS.
Prog. rpt. on gas duplexer, 1/62–3/62, 17: 6403 (RADC-TDR-62-254)

MIDWESTERN UNIVERSITIES RESEARCH ASSN., MADISON, WIS.
Achromatic beam transport system, 17: 7336 (BNL-6511(p.294-302))
Beam loading, 17: 7334 (BNL-6511(p.283-8))
Computer program for orbit stability in circular accelerators, 17: 7345 (TID-15535)
Drift tube linacs, 17: 7315 (BNL-6511(p.76-97))

MINNESOTA. UNIV., MINNEAPOLIS.
Equilibrium of electron beam in plasma, 17: 7424 (DCAS-TDR-62-42)
Polarized proton source development, 17: 7341 (BNL-6511(p.335-7))

MOL, BELGIUM. CENTRE D'ÉTUDE DE L'ÉNERGIE NUCLÉAIRE.
Prog. rpt. on in-pile corrosion of reactor materials, 3–6/62, 17: 6565 (EURAEC-413)
Prog. rpt. on reprocessing irradiated fuels, 4–6/62, 17: 6192 (EURAEC-382)
Prog. rpt. on swelling of U, 4–6/62, 17: 6740 (EURAEC-380)

N

NANCY. UNIVERSITÉ.
Geochemistry of U–Ra and Th families in Southern Vosges, 17: 6252 (CEA-2154)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, HAMPTON, VA.
Deterioration of calcia-stabilized ZrO_2, 17: 6667 (NASA-TN-D-1595)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND.
Electron-bombardment ion rocket, 17: 7644 (NASA-TN-D-1457)

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
Metallic reactions in U recovery, 17: 6184 (NBS-7582)

NATIONAL LEAD CO. OF OHIO, CINCINNATI.
Determination of U^{236} in impure U materials, 17: 5979 (TID-15359)

NATIONAL RESEARCH COUNCIL.
Refractory metals sheet rolling, 17: 6517 (MAB-188-M)

NATIONAL SANITATION FOUNDATION, ANN ARBOR, MICH.
Exposures in using radioisotopes, 17: 6320 (TID-16553)

NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
Design for cast-in-place concrete shelter, 17: 6313 (NP-12349)

NAVAL ORDNANCE LAB., WHITE OAK, MD.
Ferromagnetic resonance in garnets, 17: 6042 (NOL-TR-62-34)
Spin density distributions and Hartree-Fock calculations for Fe group series, 17: 6646 (BNL-5674)

NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Computer-aided analysis of γ spectrometer data, 17: 6442 (USNRDL-TR-592)
Cost analysis for fallout shelters, 17: 6324 (USNRDL-TR-582)
Neutron and γ dosimetry in animal exposure volume at TRIGA, 17: 5780 (USNRDL-TR-583)
Radiation effects in thermoelectrics. I., 17: 6441 (USNRDL-TR-581)
Standardization of Hurst Radsan neutron detector, 17: 6443 (USNRDL-TR-598)
Zinc bromide shielding window, 17: 7498 (USNRDL-TR-594)

NAVAL RESEARCH LAB., WASHINGTON, D. C.
Intercalibration of systems in monitoring fission products, 17: 5753 (NRL-5850)
Status rpt. on thermoelectricity, 17: 6522 (NRL-Memo-1361)

NERATOOM, N. V., THE HAGUE.
Prog. rpt. on pressure vessels, 4–6/62, 17: 6248 (EURAEC-393)

NEW ENGLAND DEACONESS HOSPITAL, BOSTON.
Radiological safety in laboratory, 17: 6319 (TID-15445)

NEW MEXICO. UNIV., ALBUQUERQUE. ENGINEERING EXPERIMENT STATION.
Plastic models in thermal stress studies, 17: 6247 (TID-17498)

NEW YORK OPERATIONS OFFICE. HEALTH AND SAFETY LAB., AEC.
Prog. rpt. on fallout, 9–12/62, 17: 5751 (HASL-132)

NEW YORK. STATE UNIV., BUFFALO.
Prog. rpt. on properties of carbons and graphites, 8–9/62, 17: 6670 (NP-12350)
NEW ZEALAND. DOMINION X-RAY AND RADIUM LAB., CHRISTCHURCH.
Prog. rpt. on fallout, 7–9/62, 17: 5750 (DXRL-F6)
NORTHERN STATES POWER CO., MINNEAPOLIS.
Prog. rpt. on Pathfinder, 4–6/62, 17: 7595 (ACNP-62018)
NORWAY. INSTITUTT FOR ATOMENERGI, KJELLER.
Mass spectrometric determinations of O-17 and O-18 in D_2O, 17: 5956 (KR-30)
Prog. rpt. on Kjeller research, 4–6/62, 17: 5656 (KR-29)
NUCLEAR MATERIALS AND EQUIPMENT CORP., APOLLO, PENNA.
Prog. rpt. on Pu fuels, 10/62, 17: 6523 (NUMEC-P-51)
NUCLEAR METALS, INC., CONCORD, MASS.
Proceedings of metallographic meeting, 17: 6524 (TID-7625)
Prog. rpt. on Be corrosion, 7/62–9/62, 17: 6568 (NMI-1905)
Prog. rpt. on refractory metals phase diagrams, 7/62–9/62, 17: 6668 (NMI-9246)
NUKLEARNI INSTITUT "JOSEF STEFAN," LJUBLJANA, YUGOSLAVIA.
Prog. rpt. on fabrication of swaged fuel elements, 4–6/62, 17: 6601 (EURAEC-372)

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Correlation of uranium α surface contamination and urinary excretion, 17: 5703 (TID-12729)
OAK RIDGE NATIONAL LAB., TENN.
Aqueous processing of Th fuels. II., 17: 6186 (ORNL-TM-420)
Chemical separation for radiomanganese, 17: 6128 (ORNL-TM-438)
Cintel flying spot microscopy, 17: 6529 (TID-7625(p.52-62))
Corrosion of materials by Li, 17: 6570 (ORNL-2674)
Corrosion of Ni-base specimens exposed in volatility plant, 17: 6571 (ORNL-TM-411)
Designs for gas-cooled reactors, 17: 7607 (ORNL-2752)
Final rpt. on radiation effects on UC_2 in graphite 1/8/63, 17: 6748 (ORNL-3340)
Gas sampling experiment in connection with Tamalpais event, 17: 5937 (ORNL-TM-445)
High-thermal-conductivity fin material for radiators, 17: 6673 (ORNL-2065)
Physical dosimetry in biological experiments with fast neutrons, 17: 6315 (ORNL-1559)
Prog. rpt. on ANP Project, 3/10/53, 17: 7606 (ORNL-1515)
Prog. rpt. on health physics, 1961, 17: 6316 (ORNL-3284)
Prog. rpt. on Molten Salt Reactor, 8-31-62, 17: 7562 (ORNL-3369)
Prog. rpt. on waste treatment and disposal, 6–7/62, 17: 7653 (ORNL-TM-396)
Thermal fatigue, 17: 6674 (ORNL-TM-405)
Thorex Th nitrate product specifications, 17: 6185 (ORNL-2056)
OFFICE OF TECHNICAL SERVICES, WASHINGTON, D. C.
Soviet research on corrosion of special alloys, 17: 6572 (OTS-61-31480)
OHIO STATE UNIV. RESEARCH FOUNDATION, COLUMBUS.
Final rpt. on imaginary part of optical potential, 1/57–9/62, 17: 7143 (TID-17357(Pt.II))
Final rpt. on scattering, 1/57–9/62, 17: 6957 (TID-17357(Pt.I))
Final rpt. on thermoelectric materials, 1/1/60–9/30/61, 17: 6633 (AD-274831)
Final rpt. on total reaction cross sections, 1/57–9/62, 17: 7144 (TID-17357(Pt.III))
OREGON STATE UNIV., CORVALLIS.
Rates of thermal polymerization of polyphenyl compounds, 17: 6113 (HW-SA-2414)

P

PARAMETRICS, INC., WALTHAM, MASS.
Preparation and properties of kryptonates, 17: 6364 (NYO-9720)
PARIS. UNIVERSITÉ.
Structure and properties of silica gel, 17: 6648 (CEA-2129)
PARKE, DAVIS AND CO., DETROIT.
Final rpt. on radiobiology, 11/62, 17: 5910 (TID-17379)
PASADENA FOUNDATION FOR MEDICAL RESEARCH, CALIF.
Human and monkey leukocytes in culture, 17: 5676 (SAM-TDR-62-99)
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Nozzle connections of pressure vessels. I., 17: 6246 (NYO-10147)
Prog. rpt. on graphite, 4/1/62–3/31/63, 17: 6531 (TID-17504)
PHILADELPHIA GENERAL HOSPITAL.
Lipid composition of liver mitochondria from normal and irradiated rats, 17: 5772 (TID-13322)
PHYSICAL RESEARCH LAB., AHMEDABAD, INDIA.
Collective vibrations in even-even nuclei with A = 30, 17: 7104 (NP-12330(p.119-21))
Nuclear interaction in T = 1 p½ doublets, 17: 7105 (NP-12330(p.122-5))
PICATINNY ARSENAL, DOVER, N. J.
Bibliography on health hazards of plastics, 17: 6318 (PLASTEC-NOTE-5)
PITTSBURGH. UNIV.
Crystal structure of pentachlorophenol, 17: 6112 (AFOSR-2541)
Deuteron-irradiated W, 17: 6736 (AFCRL-62-515)
Radiation-produced defects in doped quartz, 17: 6749 (TID-15542)
PLASMADYNE CORP., SANTA ANA, CALIF.
Magnetohydrodynamic shear heating, 17: 7427 (NP-12296)
PLESSDT (E. H.) ASSOCIATES, INC., LOS ANGELES.
Collision cross sections and atomic scattering, 17: 6774 (AFCRL-531(I))
POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR RESEARCH. WARSAW.
Intrinsic viscosity of acrylamides polymerized in solid state, 17: 6129 (PAN-308/XVII)
POWER REACTOR DEVELOPMENT CO., DETROIT.
Prog. rpt. on APDA activities, 5/62, 17: 7563 (PRDC-TR-59)
Prog. rpt. on APDA activities, 6/62, 17: 7608 (PRDC-TR-60)
PRATT AND WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP., HARTFORD, CONN.
Prog. rpt. on emissivity of materials, 7–9/62, 17: 6675 (PWA-2128)
Prog. rpt. on nuclear engineering, 7/55–6/56, 17: 7565 (PWAC-161)
Reactor and shield weights for CFRMR, 17: 7564 (PWAC-89)
PRATT AND WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP. CONNECTICUT AIRCRAFT NUCLEAR ENGINE LAB., MIDDLETOWN.
Circulating-fuel reflector-moderated reactor, 17: 7568 (PWAC-189 (Vol.I))
Circulating-fuel reflector-moderated reactor, 17: 7569 (PWAC-189(Vol.2))
Circulating-fuel reactor control, 17: 7570 (PWAC-206)
Core-moderated circulating-fuel reactor, 17: 7567 (PWAC-186)
Hazards rpt. on critical experiment at CANEL, 17: 7566 (PWAC-170)
PRINCETON UNIV., N. J.
Detection and location of cavitation, 17: 6401 (MATT-142)
Ion drift velocity in EM fields, 17: 7426 (MATT-92)
Nuclear spins and moments of Sc-44 and Sc-44m, 17: 7137 (PUC-1962-59)
Periodic annual variations in gravitational constant, 17: 6402 (PUC-1962-56)
Radioactivity of T = 0 states in V-46, Mn-50, Co-54, and Cu-58, 17: 7138 (PUC-1962-61)
Sheath criterion, 17: 7425 (MATT-77)
Single-loop four-point diagrams in $K \to 3\pi$ decay, 17: 6944 (BNL-5528)
Tensile fatigue of 335 stainless steel, 17: 6663 (MATT-154)
Valences of Ce allotropes, 17: 6047 (TID-14535)
Voltage doubler rectifier, 17: 6400 (MATT-110)
PUNJAB UNIV., CHANDIGARH, INDIA.
Coulomb energy calculations for light nuclei, 17: 7090 (NP-12330 (p.17-21))
Interference between Rayleigh and resonance scattering, 17: 7109 (NP-12330(p.147-51))

R

RADIO CORP. OF AMERICA, CAMDEN, N. J.
R-f power sources, 17: 7338 (BNL-6511(p.306-17))
RADIO CORP. OF AMERICA. ELECTRON TUBE DIV., LANCASTER, PENNA.
Prog. rpt. on dielectric to metal seal technology, 3/19/62–6/31/62, 17: 6676 (RADC-TDR-62-401)

RAND CORP., SANTA MONICA, CALIF.
Energy distribution of terms and line arrays in atomic spectra, 17: 6798 (RM-2947-AEC)
Propagation of γ rays near air-ground interface, 17: 6955 (RM-3399-PR)
RCA VICTOR CO., LTD. RESEARCH LABS., MONTREAL.
Electromagnetic waves at plasma boundary, 17: 7421 (AFCRL-62-186)
RIO DE JANEIRO. CENTRO BRASILEIRO DE PESQUISAS FÍSICAS.
Multiple scattering measurements, 17: 6954 (NP-12259)
Nuclear fission induced by 600-Mev protons, 17: 7086 (NP-12319)
ROCHESTER, N. Y. UNIV.
Valence band structure of AgCl, 17: 6053 (TID-17447)

S

SAHA INST. OF NUCLEAR PHYSICS, CALCUTTA.
Reactions (n,α) induced by 14-Mev neutrons, 17: 7094 (NP-12330 (p.46-52))
SANDIA CORP., ALBUQUERQUE, N. MEX.
Circuitry and recording equipment used with variable-resistance metallic strain gages, 17: 6405 (SCTM-364-61(73))
Electronic shaping, 17: 6598 (SCTM-39-62(25))
Microsecond timer design considerations, 17: 6404 (SCTM-168-60(24))
Nuclear explosives for improving H_2O resources, 17: 5658 (TID-16647)
Plastic models in thermal stress studies, 17: 6247 (TID-17498)
Pressures as affected by hills and dales, 17: 6276 (WT-502)
Sterilization—improvement through monitoring, 17: 6407 (TID-15453)
Timing operations of digital computing system, 17: 6500 (SCTM-144-62 (24))
Transient heat transfer in micromodules, 17: 6229 (SCTM-233-62(14))
Vector-following centrifuge fixtures, 17: 6206 (SCTM-219-62(73))
SAVANNAH RIVER OPERATIONS OFFICE, AEC.
Prog. rpt. on heavy water reactors, 11/62, 17: 7609 (SRO-75)
SOUDOMETAL, S. A., BRUSSELS.
Prog. rpt. on stainless platings of steels, 1–3/62, 17: 6534 (EURAEC-329)
Prog. rpt. on stainless platings on steels, 4–6/62, 17: 6537 (EURAEC-377)
STANFORD UNIV., CALIF.
Final rpt. on spin-zero states in even-even nuclei, 11/59–10/62, 17: 7075 (AROD-2577:2)
Long iris-loaded linacs, 17: 7320 (BNL-6511(p.128-61))
Superconducting linacs, 17: 7325 (BNL-6511(p.196-203))
SYRACUSE UNIV., N. Y.
Conference on mechanisms in metals at elevated temperatures, Racquette Lake, N. Y., 8/62, 17: 6669 (NP-12295)

T

TAPCO. DIV. OF THOMPSON RAMO WOOLDRIDGE INC., CLEVELAND.
Prog. rpt. on coatings for W, 8–10/62, 17: 6519 (NP-12293)
TATA INST. OF FUNDAMENTAL RESEARCH, BOMBAY.
Beta-γ circular polarization correlation in Eu-152, 17: 7107 (NP-12330 (p.137-40))
Beta-γ directional correlation in Eu-154, 17: 7106 (NP-12330(p.132-6))
Bismuth(γ,p) reaction, 17: 7092 (NP-12330(p.35-8))
Cross section for production of Nb isotopes, 17: 7101 (NP-12330(p.97-103))
Decay of Eu-156, 17: 7108 (NP-12330(p.141-6))
Direct interactions in low-energy nuclear reactions, 17: 7091 (NP-12330 (p.22-34))
Dynamic polarization of nuclei using magnetic resonance, 17: 7123 (NP-12330(p.224-41))
Emission of α particles in fission process, 17: 7097 (NP-12330(p.71-8))
First forbidden β spectra of Nd-147, 17: 7113 (NP-12330(p.166-71))
Isotope shifts and internal conversion, 17: 7103 (NP-12330(p.109-18))
Life time of first excited state of Sn-116, 17: 7110 (NP-12330(p.152-7))
Multiplication constants of BeO–U lattices, 17: 7131 (NP-12330 (p.392-8))
Orientation of Co-60 in alloy of Co and Fe, 17: 7115 (NP-12330(p.179-85))
Polarization of bremsstrahlung from 3.5-Mev electrons, 17: 7112 (NP-12330(p.162-5))
Preparation of NaI(Tl) scintillation crystals, 17: 7121 (NP-12330 (p.214-19))
Quadrupole coupling constants of Na-23 and B-11, 17: 7127 (NP-12330 (p.295-301))
Separation of Eu-156 and Gd-146, 149 by ion exchange, 17: 7125 (NP-12330(p.253-7))
TECHNICAL OPERATIONS, INC., BURLINGTON, MASS.
Gamma dose rate from neutron-induced activity in earth, 17: 6258 (NDL-TR-41)
TENNESSEE. UNIV., KNOXVILLE.
Corrosion of materials by Li, 17: 6570 (ORNL-2674)
TEXAS TECHNOLOGICAL COLL., LUBBOCK.
Thermal decomposition of the rare earth sulfates, 17: 6054 (UCRL-6500)
TEXAS. UNIV., AUSTIN.
Application of external energy absorbers to large fission product shipping casks, 17: 6362
Shock mitigation with vermiculite concrete, 17: 5668 (DASA-1263)
THOMPSON RAMO WOOLDRIDGE INC., CLEVELAND.
Protective coatings for Nb alloys, 17: 6510 (ASD-TDR-62-934)
TORONTO. UNIV.
Mechanics of rarefied gases and plasmas, 17: 7434 (UTIA-REV-18)
TRACERLAB. DIV. OF LAB. FOR ELECTRONICS, INC., RICHMOND, CALIF.
Prog. rpt. on scintillating ion exchange resin, 5/62, 17: 5940 (TID-15720)
TRACERLAB, INC., WALTHAM, MASS.
Prog. rpt. on radiation effects in liquid H media, 4–6/61, 17: 6747 (NP-12364)
TRANSITRON ELECTRONIC CORP., WAKEFIELD, MASS.
Final rpt. on thermoelectric materials, 1/60–7/61, 17: 6771 (AD-276005)
TURKEY. ATOMIC ENERGY COMMISSION. ÇEKMECE NUCLEAR RESEARCH CENTER, ISTANBUL.
Isotopic and isotonic yields in nuclear fission, 17: 7085 (NP-12309)

U

UNION CARBIDE CORP. PARMA RESEARCH CENTER, OHIO.
Prog. rpt. on high temperature materials, 10–12/62, 17: 6520 (NP-12373)
UNION CARBIDE CORP. RESEARCH INST., TARRYTOWN, N. Y.
Prog. rpt. on high temperature materials, 10–12/62, 17: 6520 (NP-12373)
UNION CARBIDE NUCLEAR CO. PADUCAH PLANT, KY.
Continuous leak water sampler, 17: 6398 (KY-423)
UNION CARBIDE NUCLEAR CO. Y-12 PLANT, OAK RIDGE, TENN.
In vivo γ spectrometry for inhalation studies, 17: 5704 (TID-12790)
UNITED AIRCRAFT CORP., EAST HARTFORD, CONN.
Analysis of magnetogasdynamic generators, 17: 6796 (NP-12332)
UNITED ELECTRODYNAMICS, INC., ALEXANDRIA, VA.
Seismic measurements of Small Boy, 17: 6260 (NP-12280)
Seismic measurements of Sedan, 17: 6261 (NP-12281)
Seismic measurements of Merrimac, 17: 6262 (NP-12282)
Seismic measurements of Chinchilla, 17: 6266 (NP-12298)
Seismic measurements of Aardvark, 17: 6267 (NP-12328)
Seismic measurements of Danny Boy, 17: 6268 (NP-12419)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP, SPRINGFIELDS, LANCS, ENGLAND.
Determination of Cu in uranyl nitrate solutions, 17: 5957 (PG-Report-294)
Determination of F in atmosphere, 17: 5959 (PG-Report-329)
Determination of Sb and Co in Mg-base alloys, 17: 5960 (PG-Report-337)
Determination of S in U metal and compounds, 17: 5966 (PG-Report-364)
Determination of Fe in U, 17: 5962 (PG-Report-345)
Determination of H_2O in powdered metals, 17: 5963 (PG-Report-350)
Determination of Po-210 and Th-230 in U ore, 17: 5964 (PG-Report-356)
Determination of B in Zr metal and alloys, 17: 5965 (PG-Report-362)
Determination of H, O and N in metals, 17: 5967 (PG-Report-381)
Determination of B in Zr metal, 17: 5970 (PG-Report-391)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP. CHEMICAL SERVICES DEPT., WINDSCALE, SELLAFIELD, ENGLAND.
Beta activity in vegetation, fish, sand and mud, 17: 5972 (PG-Report-

403)
Determination of β activity in neutron dosimeter, 17: 5958 (PG-Report-306)
Determination of Pu/U ratios on feed solutions, 17: 5961 (PG-Report-340)
Determination of TBP in aqueous raffinates, 17: 5974 (PG-Report-407)
Determination of Na-24 in blood, 17: 5968 (PG-Report-385)
Determination of n-butanol in TBP, 17: 5973 (PG-Report-406)
Determination of DBPA in TBP–kerosene mixtures, 17: 5971 (PG-Report-402)
Determination of butex in TBP and kerosene, 17: 5975 (PG-Report-414)
Determination of β activity due to P-32 in S disc neutron dosimeter, 17: 5969 (PG-Report-387)
Filter and assay unit for airborne radioiodine isotope, 17: 5754 (PG-Report-408)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, DOUNREAY, CAITHNESS, SCOTLAND.
Extinguishing of Pu fires, 17: 6321 (TRG-Report-342)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, SPRINGFIELDS, LANCS, ENGLAND.
End deformation problem of cylinders, 17: 6207 (TRG-Report-294)
End-fitting temperatures of fuel elements, 17: 7572 (TRG-Report-306)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP. ATOMIC ENERGY ESTABLISHMENT, WINFRITH, DORSET, ENGLAND.
Calculation of effective resonance integrals, 17: 7054 (AEEW-R-118)
Computer program for derivation of transfer functions, 17: 7530 (AEEW-R-189)
Estimation of reactor dynamic parameters, 17: 7529 (AEEW-R-179)
RASH D—program for neutron shielding calculations, 17: 7496 (AEEW-M-261)
Transfer function synthesis for reactor spatial dynamics, 17: 7531 (AEEW-R-197)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Countercurrent liquid-liquid extraction, 17: 6178 (AERE-R-4091)
Harwell Cs-137 beam therapy unit Mk II, 17: 5764 (AERE-R-3334)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. CHEMISTRY DIV., CHATHAM OUTSTATION, KENT, ENGLAND.
Determination of Fe in Zr and its alloys, 17: 5946 (AERE-AM-91)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. WEAPONS GROUP. ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKS, ENGLAND.
Afterglow ionization in hydromagnetic shock tube, 17: 7422 (AWRE-O-11/62)
Creep test apparatus for use with explosives, 17: 6242 (AWRE-O-34/62)
Determination of C in Na, 17: 5948 (AWRE-O-62/62)
Effects of machining and grinding on tensile properties of Be, 17: 6642 (AWRE-O-63/62)
Electron microscope studies of Be, 17: 6641 (AWRE-O-59/62)

UNITED NUCLEAR CORP. DEVELOPMENT DIV., WHITE PLAINS, N. Y.
Prog. rpt. on two-phase flow patterns with heat addition, 7–9/62, 17: 7613 (UNC-5042)

UNITED STATES. CONGRESS. JOINT COMMITTEE ON ATOMIC ENERGY.
Peaceful uses of atomic energy, 17: 5662
Radiation standards, including fallout, 17: 5761

UNITED STATES–EURATOM JOINT RESEARCH AND DEVELOPMENT PROGRAM.
Constitution of Zr–Nb–Sn alloys with high Zr content, 17: 6697 (EURAEC-358)
Effect of H on Zr alloys with Nb and Sn, 17: 6696 (EURAEC-353)
Prog. rpt. on Be corrosion, 7/62–9/62, 17: 6568 (NMI-1905)
Prog. rpt. on fabrication of swaged fuel elements, 4–6/62, 17: 6601 (EURAEC-372)
Prog. rpt. on forming and irradiation of UC, 1–3/62, 17: 6533 (EURAEC-325)
Prog. rpt. on in-pile corrosion of reactor materials, 3–6/62, 17: 6565 (EURAEC-413)
Prog. rpt. on power of BWR, 3–6/62, 17: 7539 (EURAEC-384)
Prog. rpt. on pressure vessels, 4–6/62, 17: 6248 (EURAEC-393)
Prog. rpt. on Pu recycling, 1–3/62, 17: 6536 (EURAEC-365)
Prog. rpt. on reprocessing irradiated fuels, 4–6/62, 17: 6192 (EURAEC-382)
Prog. rpt. on stainless platings of steels, 1–3/62, 17: 6534 (EURAEC-329)
Prog. rpt. on stainless platings on steels, 4–6/62, 17: 6537 (EURAEC-377)
Prog. rpt. on swelling of U, 4–6/62, 17: 6740 (EURAEC-380)
Prog. rpt. on two-phase flow patterns with heat addition, 7–9/62, 17: 7613 (UNC-5042)
Prog. rpt. on welding steel plates, 4–6/62, 17: 6602 (EURAEC-392)
Prog. rpt. on Zr and alloys, 4–6/62, 17: 6654 (EURAEC-394)
Zirconium alloys with Nb and Sn as canning material, 17: 6535 (EURAEC-352)
Zirconium alloys with Nb and Sn as sheathing material, 17: 6600 (EURAEC-354)

V

VITHALBHAI PATEL MAHAVIDYALAYA, VALLABH VIDYANAGAR, INDIA.
Nuclear polarization in very low magnetic fields, 17: 7126 (NP-12330 (p.259-76))

W

WATERTOWN ARSENAL, MASS.
Electron microscopy in observations of radiation damage, 17: 6746 (MRL-126)
Oxidation of graphites at elevated temperatures, 17: 6689 (WAL-TR-851.4/2)

WESTERN RESERVE UNIV., CLEVELAND.
Thermodynamic properties of SiF_4, 17: 6056 (WRU-202)

WESTINGHOUSE ELECTRIC CORP., BLAIRSVILLE, PENNA.
Extrusion of refractory alloys, 17: 6589 (ASD-TDR-62-670)
Vacuum-arc melting of W alloy, 17: 6592 (ASD-TDR-62-781)

WESTINGHOUSE ELECTRIC CORP., LIMA, OHIO.
Prog. rpt. on solar thermoelectric generator, 2–5/62, 17: 7642 (AD-276092)

WESTINGHOUSE ELECTRIC CORP. ATOMIC POWER DIV., PITTSBURGH.
CVTR fuel capsule irradiations, 17: 6739 (CVNA-153)

WESTINGHOUSE ELECTRIC CORP. BETTIS ATOMIC POWER LAB., PITTSBURGH.
Alpha-β transitions in H-Pd, 17: 6690 (WAPD-T-1268)
Irradiation behavior of ZrO_2–UO_2 fuels, 17: 6752 (WAPD-264)
Irradiation-induced phase changes in ZrO_2–UO_2 fuels, 17: 6753 (WAPD-T-1402)
Materials in Shippingport PWR, 17: 7615 (WAPD-T-1545)
Nuclear-thermal iteration analysis, 17: 7574 (WAPD-T-1225)
Prediction of tensile properties, 17: 6691 (WAPD-T-1335)
Prog. rpt. on PWR, 8/24–10/23/62, 17: 7614 (WAPD-MRP-100)

WESTINGHOUSE ELECTRIC CORP. LAMP DIV., BLOOMFIELD, N. J.
Physical metallurgy of W, 17: 6688 (WADD-TR-60-37(Pt.III))

WESTINGHOUSE ELECTRIC CORP. RESEARCH LABS., PITTSBURGH.
Biaxial brittle fracture tests, 17: 6245 (NP-12374)
Prog. rpt. on MHD research, 3/15–6/15/62, 17: 6772 (AD-276597)

Y

YALE UNIV., NEW HAVEN.
Anoxic protection of small intestine by intra-arterial catheterization, 17: 5667 (BNL-5798)
Design study of linear accelerators, 17: 7316 (BNL-6511(p.98-100))
Drift tube linacs, 17: 7313 (BNL-6511(p.50-64))
Feasibility of π-meson linear accelerator, 17: 7319 (BNL-6511(p.124-7))
Phase oscillation and transverse focusing, 17: 7314 (BNL-6511 (p.65-75))
R-f power developments, 17: 7337 (BNL-6511(p.303-5))
Secondary beams from high-energy linac, 17: 7317 (BNL-6511(p.101-9))
Shielding and experimental layout, 17: 7318 (BNL-6511(p.110-23))
Stepped phase velocity linac, 17: 7328 (BNL-6511(p.209-23))

PERSONAL AUTHOR INDEX

Each entry after an author's name is a shortened version of the title of the report or article, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt." This change permits a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

ä	becomes	ae
ö		oe
ø		oe
ü		ue (except in transliterated Chinese names)

A

ABBATTUCCI, S., Experimental radiobiology of tumors, 17: 5812

ABDEL-BARY, Ahmed F. Mohammed, Final rpt. on imaginary part of optical potential, 1/57–9/62, 17: 7143 (TID-17357(Pt.II))

ABELE, Maolio, Radiation by uniformly rotating point charge, 17: 6797 (PIBAL-753)

ABKIN, A. D., Radiation effect on combined acrylonitrile and ethylene polimerization, 17: 6166

ABRAGAM, Anatole, Measurement of dynamic nuclear polarization, 17: 7164

ABRAMSON, Edward, X-ray-induced strain and coloration in KCl, 17: 6866

ABRAMSON, M. B., Interaction of myristic acid monolayers with Th, 17: 6079

ABRAO, Alcidio, Determination of Cd in U, 17: 5953 (IEA-48)

ABSON, W., Monitoring of mixed neutron and γ doses, 17: 6479

ACHENER, P. Y., Prog. rpt. on Rb/Cs evaluation, 6–9/62, 17: 6635 (AGN-8069)

ACHERMANN, A. H., Ceramic spraymat, 17: 6205 (CERN-62-28)

ACKERMAN, M., Heats of vaporization of solids. I., 17: 6095

ADAIR, J. R., Joining of U, 17: 6629

ADAM, H., Nuclear training in Western Europe, 17: 5661

ADAMS, G. M., Biharmonic Green's function, 17: 6846

ADAMS, J. A. S., Conway granite of New Hampshire, 17: 6297

ADAMS, P. H., Circuitry and recording equipment used with variable-resistance metallic strain gages, 17: 6405 (SCTM-364-61(73))

ADKINS, A. W., Computer program for thin-shell problem, 17: 6507

ADLOFF, J.-P., Solution chemistry of Pb-210, Bi-210, and Po-210. II., 17: 6153

AFANASEV, A. M., Law of dispersion of phonons, 17: 6892

AFONIN, O. F., Cascade Coulomb excitation of rotational levels, 17: 7290

AGNEW, Louis, Antiproton-nucleon cross sections, 17: 6959 (UCRL-9288(Rev.))

AGUILAR, J. Estrada, Ion exchange of natural leaching solutions, 17: 6193

AINUTDINOV, M. S., Multiple production of π mesons in πp collisions, 17: 7035

AKABOSHI, Mitsuhiko, Incorporation of P-32 into nucleic acids of γ-irradiated tumor cells, 17: 5832

AKAGI, Hiroaki, Neutron dosimetry with nuclear track emulsion, 17: 6323 (UCRL-9967)

AKHIEZER, A. I., Effect of radiation processes on transport phenomena in plasma, 17: 7488

AKIMOV, V. K., Determination of Os in presence of Ru, 17: 6014

AKKERMAN, A. F., Lifetime of the level 4⁺ (1282 kev) of Cd-114, 17: 7283

AKOEV, I. G., Effect of thyroxine on erythropoesis in irradiated animals, 17: 5883

AKUTSU, Cho, Corrosion of Al in high-pressure steam, 17: 6580

ALBAUGH, F. W., Prog. rpt. on heavy water reactors, 11/62, 17: 7602 (Hw-75725)

ALBENESIUS, E. L., Control of T health hazards, 17: 6309 (DPSPU-62-30-5)

ALCOCK, M. W., Afterglow ionization in hydromagnetic shock tube, 17: 7422 (AWRE-O-11/62)

ALDER, J. C., Efficiency of detector shielding, 17: 7067

ALDER, J. C., Light yield of solution NE 213 to protons, 17: 6119

ALEKSANDROV, A. Yu., Shifts of γ transition of Sn-119 in organo-tin compounds, 17: 7281

ALEKSANDROV, Yu. A., Decay scheme of Eu-148, 17: 7181

ALEKSANDROV, Yu. A., Sensitivity of liquids to radiation, 17: 6472

ALEKSEEVA, V. M., Determination of rare earths in rocks, 17: 6008

ALESCIO, T., Lethal γ dose for *Mus musculus*, 17: 5863

ALESKOVSKII, Yu. M., Volume recombination in He plasma, 17: 7480

ALEXANDER, John M., Recoil study of $C^{14}(p,pn)C^{13}$, 17: 7147 (UCRL-9911)

ALEXEFF, I., Ionic sound waves in plasmas, 17: 7470

ALFF, C., Decays of the ω and η mesons, 17: 6998

ALFF, C., Pion resonances in π -p interactions, 17: 6997

ALFORD, W. L., Isomeric transition in Sm-143, 17: 7237

ALFVEN, H., Origin of satellites and planets, 17: 6908

ALIMARIN, I. P., Chemistry of Ta and Nb, 17: 6022

ALIMARIN, I. P., Determination of Ti, Zr, Th, and Sc, 17: 6016

ALI ZAIDI, S. R., Final rpt. on thermoelectric materials, 1/1/60–9/30/61, 17: 6633 (AD-274831)

ALLEN, F. C., Sputtering of solids, 17: 6813 (NP-tr-930)

ALLEN, J. E., Plasma research, 17: 7440

ALLEN, J. S., Beam extraction from Univ. of Illinois cyclotron, 17: 7403

ALLEN, Thomas L., Electron pairs in Be atom, 17: 6842

ALLGOOD, J. R., Design for cast-in-place concrete shelter, 17: 6313 (NP-12349)

ALLRED, A. L., Strengths of H bonds, 17: 6120

ALPERIN, Harvey A., Spin density distributions and Hartree-Fock calculations for Fe group series, 17: 6646 (BNL-5674)

ALPERT, J. L., Nuclear explosions at high altitudes, 17: 6296

ALSINA, F., Central forces in relativistic mechanics, 17: 6885

ALTENBRUNN, H. J., Radiation effects on oxidative phosphorylation in mitochondria, 17: 5784

ALTMAN, K. I., Creatine concentration in erythrocytes, 17: 5856

ALTMAN, K. I., Metabolism of saccharides after whole-body x irradiation, 17: 5828

AMMIRAJU, P., Polarization of bremsstrahlung from 3.5-Mev electrons,

17: 7112 (NP-12330(p.162-5))
AMOROS, J. L., Thermal agitation in molecular crystals, 17: 6062
ANASHKINA, E. S., Photoneutrons from In-115, 17: 7280
ANDERKO, Kurt, Corrosion-resistant Zr alloys, 17: 6581
ANDERS, Edward, Meteorites and early history of solar system, 17: 6902 (EFINS-62-50)
ANDERS, Oswald U., Identification of 5-second Br activity, 17: 5983
ANDERSON, J. C., Computer program for orbit stability in circular accelerators, 17: 7345 (TID-15535)
ANDERSON, J. D., Lifetimes of excited nuclear states, 17: 6958 (UCRL-7091)
ANDERSON, J. E., Influence of charge separation and current inertia on shock structure, 17: 6901
ANDERSON, John A., Radiation-produced defects in doped quartz, 17: 6749 (TID-15542)
ANDERSON, John M., Gaseous discharge in He, 17: 7437
ANDERSON, N. J., Equilibrium H_2O content of ion exchange resins, 17: 5939 (TID-13384)
ANDERSON, P. W., Flux creep in hard superconductors, 17: 6876
ANDERSON, Samuel, Stability and solubility of Ni(II)-*vic*-dioxime complexes, 17: 6114 (IS-434)
ANDERSON, W. A., R-f fields in nuclear magnetic double resonance, 17: 6076
ANDERSON, Weston A., Modulation techniques and NMR spectrometers, 17: 6421
ANDERSSON, I. O., Gamma spectrum of Swedish Laplanders, 17: 5763 (AE-80)
ANDOU, Kouzou, Hot plasma produced by linear discharge device, 17: 7449
ANDREEV, G. B., Proton scattering by B-10, 17: 7176
ANDREEV, S. I., Effect of magnetic field on pulsed discharge in Ar, 17: 7486
ANDREEV, S. V., Survival rate and sexual sterilization of granary weevil, 17: 6368
ANDREEVA, T. S., Radiation injuries of cranial bones in a child, 17: 5849
ANDREW, J. F., Prog. rpt. on properties of carbons and graphites, 8–9/62, 17: 6670 (NP-12350)
ANDRONIKASHVILI, E. L., He(II) rotation near λ point, 17: 6895
ANGER, W., Collector system for condenser banks of high-energy content, 17: 6397 (JÜL-72-PP)
ANGERMAN, C. L., Microstructural changes during α-β-α transformation of U, 17: 6680 (TID-15539)
ANISIMOV, A. A., Transport of organic plant substances, 17: 5756
ANSON, Sally G., Sensitization of blood vessels to damage by x irradiation, 17: 5844
ANTELME, G., Vaporization of U and U carbides, 17: 6110
ANTHROP, D. F., Prog. rpt. on thermodynamics of refractory compounds, 9-11/62, 17: 6045 (RAD-SR-62-251)
ANTUF'EV, Yu. P., Decay scheme of K-41, 17: 7177
ARAMAKI, Seiye, Scattering amplitude and consistency of dispersion relation, 17: 7010
ARBIT, Jack, Emotionality and avoidance conditioning to x radiation, 17: 5837
ARENTZ, Andrew A., Jr., Dynamically loaded underground structures, 17: 5666 (SF-274294)
ARIMIZU, N., Method of thyroid I-131 uptake, 17: 5743
ARNOLD, E. D., Thorex Th nitrate product specifications, 17: 6185 (ORNL-2056)
ARNOLD, J. A., Microsecond timer design considerations, 17: 6404 (SCTM-168-60(24))
ARON, Paul R., Superconductivity tests and studies, 17: 6807 (UCRL-9819)
ARTHUR, J. C., Jr., Copper-64 in study of reaction mechanisms of enzymes, 17: 5696
ARTHUR, John R., Jr., Adsorption of hydrocarbons on clean Ir, 17: 6660 (IS-462)
ARTSIMOVICH, L. A., Effect of magnetic field on toroidal electric discharge, 17: 7445
ARULDHAS, G., NMR spectra of A_3B_3X system, 17: 7124 (NP-12330 (p.242-8))
ARUSHANOV, G. G., Vector mesons in elastic scattering of π mesons and protons, 17: 7045
ARYTYUNYAN, V. M., Photoproduction of strange particles, 17: 7051
ASARO, F., Perturbation of α-γ angular correlations in Am-241, Am-243, and Cm-243, 17: 7219
ASHBURN, L. L., Irradiation and 3-methylcholanthrene administration in breast tumor, 17: 5839
ASHLEY, James Wilfred, Fuel element charging and discharging arrangements, 17: 7590
ASKWYTH, W. H., Emittance of materials, 17: 6731
ASKWYTH, W. H., Prog. rpt. on emissivity of materials, 7–9/62, 17: 6675 (PWA-2128)
ASSCHER, A. W., Sensitization of blood vessels to damage by x irradiation, 17: 5844
ASTALDI, G., Effects of x radiation in hemic cells, 17: 5862
ATKINS, R. W., Joining of Be, 17: 6628
ATKINSON, J. S., Power cycling of high-power-density fuel specimens, 17: 6513 (GEAP-4069)
ATSARKIN, V. A., Radiospectroscope limit sensitivity, 17: 6413 (SCL-T-449)
ATTANAS, J. G., Lithium hydride casting, 17: 6596 (DC-61-7-27)
ATTERLING, Hugo, Beam-transport system for Berkeley cyclotron, 17: 7409
AUERBACH, K., Rotation levels of Er-168, 17: 7270
AUGENSTINE, L. G., Radiation effects on enzymes, 17: 5767 (BNL-5727)
AULT, G. Marvin, Refractory metals sheet rolling, 17: 6517 (MAB-188-M)
AUSTERMAN, S. B., Rapid O diffusion in BeO, 17: 6666 (NAA-SR-7637)
AUTHIER, A., X-ray transmission in Si crystals. I., 17: 6063
AUTHIER, A., X-ray transmission in Si crystals. II., 17: 6064
AUTHIER, Andre, Damage caused by proton irradiation, 17: 6759
AVIVI, P., Time lag of gas breakdown, 17: 6821
AWA, Akio, Human and monkey leukocytes in culture, 17: 5676 (SAM-TDR-62-99)
AWCOCK, M. L., Counter for measurement of fast neutron spectra, 17: 6481
AXE, Roy, Irradiation of spheroidal bodies, 17: 6224
AXELRAD, D. R., Furnace for studies of mechanical properties of materials up to 2000°C, 17: 6212
AYELA, Fernand, Calorimeter for measurement of in-pile heat evolution, 17: 6386 (CEA-2190)
AYER, Frederick, II., Bubble-chamber track measuring stage, 17: 6463
AYER, Frederick, II., Bubble chamber track-centering device, 17: 6464
AYNARD, Rose, Diamagnetic susceptibility of elements, 17: 6828
AYRE, James Lewis, Charge/discharge systems for GCR, 17: 7585
AYRES, J. A., Corrosion aspects of reactor decontamination, 17: 6588
AZAM, M. N., Electron microscope studies of U–Mo alloys, 17: 6712
AZHGIREI, L. S., Amplitudes of nucleon-nucleon scattering, 17: 7080 (JINR-P-1024)
AZHGIREI, L. S., Elastic scattering of protons by carbon nuclei, 17: 7081 (JINR-P-1025)
AZUMA, Iwao, Burden to surface in rotational irradiation, 17: 6359
AZZONI, P., POLLY—one group Fermi age, 17: 6495 (CNEN-140)

B

BABCOCK, R., Operation of superconducting solenoid, 17: 6756
BABELIOWSKY, T. P. J. H., Heat of vaporization of solid elements, 17: 6093
BABICKY, Arnost, Calcium exchange in the epi- and metaphysis after local x irradiation. IV., 17: 5901
BABKO, A. K., Separation of rare earths by chromatographic method, 17: 6009
BABLIDZE, R. A., He(II) rotation near λ point, 17: 6895
BABYKIN, M. V., Capture and containment of plasma, 17: 7485
BACHYNSKI, M. P., Electromagnetic waves at plasma boundary, 17: 7412 (AFCRL-62-186)
BADER, Michel, Explorer 12 data on protons below 20 kev, 17: 6923
BADRINATHAN, C., Life time of first excited state of Sn-116, 17: 7110 (NP-12330(p.152-7))
BAECKSTROEM, G., Search for two-quantum decay of In-114m, 17: 7210
BAES, C. F., Jr., Extraction of metallic species by dialkylphosphoric acids, 17: 6197
BAILEY, W. J., Irradiation of UO_2–PuO_2 capsules, 17: 6745 (HW-SA-2675)
BAKER, C., Widening Bragg peak in path of charged heavy particles in tissue, 17: 5766 (BNL-5538)

BAKER, Cyril John, Curing of silicones by irradiation, 17: 6769
BAKER, R. C., Continuous leak water sampler, 17: 6398 (KY-423)
BAKER, R. G., Whole-body scanning in medicine. I., 17: 5684
BAKER, R. G., Whole body scanning in medicine. II., 17: 5806
BALABUKHA, V. S., Complexons for accelerating elimination of Ce-144, 17: 5739
BALAKRISHNAN, M., Life time of first excited state of Sn-116, 17: 7110 (NP-12330(p.152-7))
BALASHOV, V. V., Fast nucleon reactions with light nuclei, 17: 7188
BALASHOV, V. V., Interaction of fast nucleons with light nuclei, 17: 7209
BALASHOV, V. V., Level structure of (γ,d) reaction on light nuclei, 17: 7185
BALAZS, Louis A. P., Low-energy pion-pion scattering. II., 17: 6987
BALESCU, R., Non-equilibrium thermodynamics, 17: 6107
BALIKA, Yu. D., Effect of Sr and F on hemopoiesis in rats, 17: 5822
BALLINGER, E. R., Body Na-24 activity as measure of body dose, 17: 5775 (TID-14529)
BALLUFFI, R. W., Neutron damage in Ge, 17: 6757
BANKS, Charles V., Stability and solubility of Ni(II)-*vic*-dioxime complexes, 17: 6114 (IS-434)
BANKS, Charles V., *vic*-Dioximes as analytical reagents, 17: 5954 (IS-431)
BARANOV, S. A., Fine structure of the Pu-239 α radiation, 17: 7277
BARBA, P. M., Transient heat transfer in micromodules, 17: 6229 (SCTM-233-62(14))
BARBER, Donald E., Exposures in using radioisotopes, 17: 6320 (TID-16553)
BARBIER, M., Isochronous cyclotron meson factory, 17: 7395
BARCATTA, F., Material for ion propulsion, 17: 6544
BARDIN, B. M., Field design for Univ. of Colorado cyclotron, 17: 7372
BARDWICK, J., University of Michigan 83-inch cyclotron. IV., 17: 7367
BARMAN, V. V., Resonance in $K^0\bar{K}^0$ pair production, 17: 7039
BARMIN, V. V., Generation of π^0 mesons in Coulomb field of nucleus, 17: 7020
BARMORE, Willis L., Compressive creep of BeO, 17: 6684 (UCRL-6748)
BARNES, R. S., Interstitial dislocation loops in Al, 17: 6765
BARR, H., Stabilized and hydration-resistant Eu_2O_3, 17: 6664 (MND-M-2346)
BARR, R. Q., Arc-cast Mo- and W-base alloys, 17: 6672 (NP-12383)
BARR, William L., Diagnostic measurements on P-4 steady-state plasma, 17: 7432 (UCRL-6562)
BARREIRA, F., Atmospheric radioactivity in Lisbon, 17: 6355
BARREIRA, F., Cattle and sheep thyroid activity, 17: 5740
BARREIRA, F., Determination of Sr-90 in bone. I., 17: 5741
BARREIRA, F., Radioiodine in thyroid glands, 17: 6354
BARRETT, Alan H., Microwave radiation from planet Mercury, 17: 6907
BARRETT, C. S., Crystal structure variations in alpha U at low temperatures, 17: 6721
BARRIONUEVO, M., Lipid composition of liver mitochondria from normal and irradiated rats, 17: 5772 (TID-13322)
BARRY, P. J., Maximum permissible concentrations of radioactive nuclides in airborne effluents, 17: 6308 (CRER-1098)
BARTH, Gunther, Bone marrow transplantation after whole-body irradiation, 17: 5920
BARTL, Otakar, Decontamination of metal surfaces, 17: 6343
BARTON, G., Single-loop four-point diagrams in $K \to 3\pi$ decay, 17: 6944 (BNL-5528)
BARTON, G. W., Jr., Vaporization of Gd and Th dicarbides, 17: 6109
BARYAKHTAR, V. G., Effect of radiation processes on transport phenomena in plasma, 17: 7488
BASKEY, R. H., Fuel bearing Fiberglas, 17: 6530 (TID-16847)
BASS, F. G., Transformation and scattering of waves on fluctuations in plasma, 17: 7483
BASS, Raymond Leslie, Curing of silicones by irradiation, 17: 6769
BASSANI, Franco, Valence band structure of AgCl, 17: 6053 (TID-17447)
BASSEL, R. H., Analyzing methods for ORIC magnetic fields, 17: 7385
BASSON, J. K., Detector for intermediate energy neutrons, 17: 6478
BASU MALLIK, M. K., Radiation necrosis of bladder, 17: 5787
BATCHELOR, A. L., Intercomparison of fast neutron dosimetry, 17: 6480
BATCHELOR, K., Beam observations in P.L.A., 17: 7330 (BNL-6511 (p.235-60))
BATCHELOR, K., Long iris-loaded linacs, 17: 7323 (BNL-6511(p.174-83))
BATCHELOR, K., P.L.A. of Rutherford Laboratory, 17: 7311 (BNL-6511 (p.19-37))
BATCHELOR, K., Superconducting linacs, 17: 7324 (BNL-6511(p.184-95))
BATE, L. C., Chemical separation for radiomanganese, 17: 6128 (ORNL-TM-438)
BATES, J. L., Movement of fission fragments and Pu in UO_2 irradiation tests, 17: 6742 (HW-SA-2309)
BAUER, A. A., Impurity content determination of U and high-U alloys, 17: 6528 (TID-7625(p.45-51))
BAUER, Arthur A., Fission-product-release measurement from clad fuel, 17: 6645 (BMI-1604)
BAUER, R. W., Lifetimes of excited nuclear states, 17: 6958 (UCRL-7091)
BAUM, P. M., Determination of ρ,γ,π coupling constant, 17: 7001
BAUMANIS, A. M., Prog. rpt. on coating-metal bonds, 7–9/62, 17: 6509 (ARF-1213-5)
BAUMANN, C. G., Gamma-induced polymerization of α methyl styrene, 17: 6124 (BNL-5838)
BAUMANN, Norman P., Diffusion coefficient for thermal neutrons in D_2O, 17: 7058 (TID-15165)
BAUMGARTNER, E., Polarization capacity of O, 17: 7064
BAUMGARTNER, E., Polarization capacity of Cu and Zr, 17: 7065
BAUMGARTNER, E., Polarization of neutrons from (d,t) reaction, 17: 7066
BEAUMEVIEILLE, Henri, Angular distributions from $B^{11}(p,\alpha_0)$, 17: 7163
BEAVER, W. W., Prog. rpt. on intermetallic compounds, 7–9/61, 17: 6643 (BBC-112)
BECHER, A. F., Correlation of uranium α surface contamination and urinary excretion, 17: 5703 (TID-12729)
BECK, W. N., Capsules for irradiations in reactor, 17: 7630 (ANL-6554)
BECKER, J., Radiation research and treatment, 17: 5698
BECKER, Kurt M., Burnout conditions for flow of boiling H_2O in vertical round ducts, 17: 7528 (AE-87)
BECKHUIS, H., Half life of Pm-147, 17: 7264
BEE, R., End-fitting temperatures of fuel elements, 17: 7572 (TRG-Report-306)
BEEBE, Gilbert W., Program of Atomic Bomb Casualty Commission, 17: 6332
BEGEMANN, F., Prog. rpt. on T determination, 11/60-10/61, 17: 5947 (AFCRL-62-295)
BEGER, H., Nanosecond high-voltage pulses for internal cyclotron beam deflection, 17: 7344 (CERN-62-25)
BEGUM, R. J., Inelastic scattering of cold neutrons in BeO, 17: 7130 (NP-12330(p.384-91))
BEHRISCH, Rainer, Sputtering of solids, 17: 6813 (NP-tr-930)
BEKEFI, G., Microwave emission from non-Maxwellian plasmas, 17: 7469
BELENKII, S. N., Fine structure of the Pu-239 α radiation, 17: 7277
BELL, Alan, Measuring static gas pressures in pressure vessels, 17: 6429
BELL, Francis Robert, Nuclear power installations, 17: 7586
BELL, Francis Robert, Nuclear power plants, 17: 7587
BELL, W., Prog. rpt. on chemistry of fission product elements, 8/59-7/60, 17: 6036 (GA-1536)
BELLMAN, Richard, New formalism in perturbation theory, 17: 6508
BELOUSOV, A. S., Photoproduction of π^0 in H and D, 17: 7036
BELYAEV, B. N., Formation of At-209 and At-207, 17: 7276
BELYAK, V. I., Collective excitations of nuclei, 17: 7184
BEM, P., Polarization of protons scattered on C, 17: 7166
BENAZZI, Mario, Radiation effect on planaria development, 17: 5789
BENDALL, D. E., RASH D—program for neutron shielding calculations, 17: 7496 (AEEW-M-261)
BENDER, R. S., Analyzing methods for ORIC magnetic fields, 17: 7385
BENENSON, R. E., Differential cross sections for $C^{14}(d,n)N^{14}$ and $O^{18}(d,n)F^{18}$, 17: 7239
BENENSON, R. E., n-p Total cross section at 0.4926 and 3.205 Mev, 17: 6976
BENNETT, E. F., Proportional counter proton-recoil spectrometer, 17: 6462
BENNETT, R. A., Neutron rethermalization in graphite and H_2O, 17: 7055 (HW-SA-2415)
BENSON, P. R., Fouling test for organic reactor coolants, 17: 7561 (NAA-SR-7362)
BENTLE, G. G., Properties of U carbide and BeO, 17: 6554
BENVENISTE, Mireille, Electric conductivity of irradiated LiF, 17: 6760
BENZ, R., Thermodynamics of $PuCl_3$, 17: 6048 (TID-14538)

BERANGER, R., Statistical pulse generator, 17: 6387 (CEA-2198)
BERDJIS, C. C., Irradiation as cause of masculinization in submaxillary glands, 17: 5800
BERENYI, Denes, Vacuum evaporator for preparing radioactive sources, 17: 6158
BEREZHNOI, Yu. A., Reactions of total decay of nuclei, 17: 7282
BERG, M., Prog. rpt. on dielectric to metal seal technology, 3/19/62–6/31/62, 17: 6676 (RADC-TDR-62-401)
BERGE, Pierre, Electric conductivity of irradiated LiF, 17: 6760
BERKUTOV, A. N., Therapy of acute radiation sickness, 17: 5925
BERLEY, D., Decays of the ω and η mesons, 17: 6998
BERLEY, D., Pion resonances in π^+-p interactions, 17: 6997
BERLEY, David, Inelastic charge exchange of K^+ mesons, 17: 6966
BERLINCOURT, T. G., Transition metal alloy superconductors, 17: 6874
BERLMAN, Isadore B., Pyrene dimers, 17: 5938 (TID-13249)
BERLOVICH, E. E., Lifetimes of excited states Dy-160, Lu-175, Hf-177, and Ir-191, 17: 7292
BERMAN, R. M., Irradiation behavior of ZrO_2–UO_2 fuels, 17: 6752 (WAPD-264)
BERMAN, R. M., Irradiation-induced phase changes in ZrO_2–UO_2 fuels, 17: 6753 (WAPD-T-1402)
BERNHARD, K., Influence of irradiation on skin lipids, 17: 5825
BERNSTEIN, Ira B., Transport coefficients in fully ionized plasma, 17: 7455
BERNSTEIN, Richard B., Scattering of atomic beams of K and Cs by Hg, 17: 6836
BERRET, Rene, Determination of urea, 17: 6032
BERTAUT, Felix, Magnetic structure of alloys YCo_5 and $HoCo_5$, 17: 6706
BERTHELOT, C., Ionization potential of Pu, 17: 7195
BERTIN, Daniel, Determination of urea, 17: 6032
BEST, G. T., Capture of small particles by solar radiation field, 17: 6914
BETCHOV, Robert, Plasma turbulence, 17: 7492
BETHE, H. A., Reference spectrum method for nuclear matter, 17: 7214
BETOFF, Nikola, Formation of organic substances from CO_2 by γ radiation, 17: 6168
BETTINALI, Carlo, Products formed by heating Ca and Th phosphates, 17: 6061
BEU, K. E., Modifications of cylindrical powder diffraction camera, 17: 6392 (GAT-T-973)
BEVERLY, W. B., Energy dependence of proportional counter neutron dosimeter, 17: 6477
BEVILACQUA, Frank, Safety of BONUS reactor power station, 17: 7625
BEYER, H., Yttrium-90 needles in interstitial β therapy, 17: 5695
BEYER, Norman S., New techniques in radiography, 17: 5980 (TID-15512)
BEYNON, W. J. G., Ionospheric effects of nuclear explosions, 17: 6847
BHAKAR, B. S., Binding energy of H-3 and n-d scattering lengths, 17: 7089 (NP-12330(p.15-16))
BHASIN, V. S., Binding energy of H-3 and n-d scattering lengths, 17: 7089 (NP-12330(p.15-16))
BHAT, T. R., Plate theory applied to displacement chromatography, 17: 6004
BHATTACHARYA, Ashok K., Electronic thermal conductivity in magneto-plasmas, 17: 7468
BHATTACHERJEE, S. K., Beta-γ directional correlation in Eu-154, 17: 7106 (NP-12330(p.132-6))
BHATTACHERJEE, S. K., Beta-γ circular polarization correlation in Eu-152, 17: 7107 (NP-12330(p.137-40))
BHIDAY, M. R., Absolute electron-electron scattering cross section, 17: 7117 (NP-12330(p.193-8))
BHIDE, G. K., Preparation of NaI(Tl) scintillation crystals, 17: 7121 (NP-12330(p.214-19))
BIAGINI, C., Lethal γ dose for *Mus musculus*, 17: 5863
BIDWELL, Richard M., Fission product in liquid metal fueled reactors, 17: 7611 (TID-14495)
BIEBER, Erhard, Neutron capture spectrum of Sm-150, 17: 7273
BIGELOW, C. C., Circulating-fuel reflector-moderated reactor, 17: 7568 (PWAC-189(Vol.1))
BIGELOW, C. C., Circulating-fuel reflector-moderated reactor, 17: 7569 (PWAC-189(Vol.2))
BIGELOW, John Edward, Condensation nuclei detector, 17: 6488
BIGOZZI, U., Morphology of "drumsticks" in the rabbit, 17: 5798
BIGOZZI, U., Rabbit "drumsticks" after pan irradiation, 17: 5797
BILDSTEIN, H., Coated fuel particles, 17: 7577
BILIMOVECH, G. N., Chemistry of Ta and Nb, 17: 6022
BIRCZ, R., Determination of Zn in U, 17: 6001
BIRKS, L. S., Distribution of Ca in epiphyseal cartilage, 17: 5727
BIRNBAUM, M., Radioactive tracers in study of subterranean water flow, 17: 6377
BISSON, Charles, Winds aloft for selected seasons, 17: 6251 (CDRP-182-109)
BJERLE, I., Powder mixing with short-lived radioisotopes, 17: 6374
BLACKBURN, Robert, Determination of P in Al–Si alloys, 17: 5994
BLACKMAN, V. H., Performance of crossed-field plasma accelerator, 17: 7647
BLAISE, A., Balance for measuring magnetic susceptibilities at high or low temperatures, 17: 6385 (CEA-2187)
BLANC, D., Specific gravity of H_2O–steam emulsion, 17: 6378
BLANC, Georges, Electric conductivity of irradiated LiF, 17: 6760
BLANCHARD, Cyrus L., Ionizing radiation and the ear, 17: 5834
BLANCO, R. E., Aqueous processing of Th fuels. II., 17: 6186 (ORNL-TM-420)
BLANCO, R. E., Prog. rpt. on waste treatment and disposal, 6–7/62, 17: 7653 (ORNL-TM-396)
BLANK, A. Ya., Transformation and scattering of waves on fluctuations in plasma, 17: 7483
BLANPIED, W. A., Secondary beams from high-energy linac, 17: 7317 (BNL-6511(p.101-9))
BLAQUIERE, Augustin, Neutron fluctuations of Ulysee reactor, 17: 7638
BLAUGHER, R. D., Critical magnetic fields of superconducting Mo, 17: 6857
BLECHER, W. A., Circulating-fuel reactor control, 17: 7570 (PWAC-206)
BLEIBERG, M. L., Effects of burnup on ceramic fuel, 17: 6755
BLEIBERG, M. L., Irradiation behavior of ZrO_2–UO_2 fuels, 17: 6752 (WAPD-264)
BLEWETT, J. P., Bunchers, 17: 7331 (BNL-6511(p.261-6))
BLINOV, M. V., Angular anisotropy of γ quanta accompanying U-235 fission, 17: 7293
BLOCH, C., First excited states of closed shell nuclei, 17: 7088 (NP-12330(p.1-14))
BLOCH, J., Radiocrystallography of radioactive materials, 17: 6758
BLOCHER, John M., Jr., Viscosity of saturated liquid K, 17: 6671 (NP-12366)
BLOKHINTSEV, D. I., Causality in present field theory, 17: 6793 (JINR-P-1090)
BLOKHINTSEV, D. I., Propagation of signal inside elementary particle, 17: 6951 (JINR-P-1091)
BLOKHINTSEV, L. D., Feynman amplitudes for nonrelativistic processes, 17: 7524
BLOOM, S. D., Electron spectrum observed on Discoverer satellites, 17: 6917 (UCRL-6792-T)
BLOOMQUIST, Carol A. A., Determination of Rh, 17: 5985
BLUDMEN, A., Electromagnetic properties of charged vector meson, 17: 6961 (UCRL-9889)
BLUNN, O. M., Inner radiation belt at 320 km in South Atlantic magnetic anomaly, 17: 6937
BLUNN, O. M., Outer radiation belt of earth at 320 km, 17: 6936
BOCHAGOV, B. A., Energy distributions of U-238 photofission fragments, 17: 7291
BOCHAGOVA, D. I., Therapy of acute radiation sickness, 17: 5925
BOCK, R. M., Separation of labeled from unlabeled proteins, 17: 5710
BODENSTEDT, E., Rotation levels of Er-168, 17: 7270
BOEDEGE, R., Power reactors in Western Europe, 17: 7621
BOEHME, G., West-European laboratories for radioactive materials, 17: 6157
BOETHIN, Theo, Determination of Hf and Zr, 17: 6002
BOGATIN, V. I., Disintegration of C-12 into three α particles, 17: 7288
BOGATOV, L. V., Phagocytosis of leukocytes after external γ irradiation, 17: 5884
BOGEN, Donald C., Prog. rpt. on high-altitude sampling program, 12/1/62, 17: 6271 (NYO-10464)
BOGUSH, A. A., Scattering of electrons on protons, 17: 7050
BOHL, Robert W., Uranium–fissium alloys containing Tc, 17: 6718
BOHM, David, Rotator model of elementary particles in Minkowski space. I.,

17: 6981
BOHM, Henry V., Critical field of superconducting Mo, 17: 6877
BOHNDORF, Werner, Dose distribution by horizontal motion of telecobalt apparatus, 17: 6357
BOILLY, Bononi, Inhibition of caudal regeneration by x rays, 17: 5808
BOKROS, J. C., Evaluation of (Th,U)C_x, coated (Th,U)C, particles, and C coatings, 17: 6655 (GA-3067)
BOLDHABER, Solomith, Spin of the K* resonance, 17: 7000
BOLDT, Elihu, Inelastic charge exchange of K^+ mesons, 17: 6966
BOLT, G. H., Isotopic exchange of K in illite, 17: 6102
BOLTAX, A., Swelling in α-irradiated Al and Al alloys, 17: 6761
BOLZE, Ernest M., Bubble-chamber track measuring stage, 17: 6463
BOND, Victor P., Anoxic protection of small intestine by intra-arterial catheterization, 17: 5667 (BNL-5798)
BONIN, M. A., Radiation polymerization of cyclopentadiene at −78°, 17: 6149
BOOKS, Kenneth G., Aeroradioactivity survey and geology of Los Angeles region, 17: 6253 (CEX-59.4.16)
BOOM, R. W., Radiation survey at LRL cyclotron, 17: 7401
BOON, J. P., Viscosity of liquid deuteromethane, 17: 6094
BORCHERS, R. R., Fast neutron time-of-flight spectrometer, 17: 6465
BORCHERS, R. R., Neutrons from D + T and D + H, 17: 7241
BORDWELL, Leona O., Hafnium cross sections and temperature dependence, 17: 7084 (LA-2763)
BORGHESE, E., Lethal γ dose for *Mus musculus*, 17: 5863
BORGHINI, Michel, Measurement of dynamic nuclear polarization, 17: 7164
BORISENKO, L. F., Scandium: geochemistry and mineralogy, 17: 6301
BORISON, Sidney L., Particle and antiparticle high-energy cross sections, 17: 6980
BORISOV, V. P., Emergency aid in I-131 intoxication, 17: 6005
BORMANN, H. J., Neutron flux measurements in FRJ-1 Merlin, 17: 7634 (JÜL-75-RE)
BORN, H. J., Production and application of radionuclides in Europe, 17: 6156
BORNEMISZA, Gyoergyne, Reaction $Be^9(n,p)Li^9$ at 14.81 Mev, 17: 7198
BORSANYI, Steven J., Effects of radiation therapy on the ear, 17: 5896
BORSANYI, Steven J., Ionizing radiation and the ear, 17: 5834
BOSE, A., Radioprotective efficacy of cysteamine, 17: 5858
BOSTROM, C. O., Solar protons and magnetic storms, July 1961, 17: 6920
BOTTREAU, Andre, Magnetic resonance of irradiated glycocol, 17: 6154
BOUNDY, R. A., Tensile properties of low-alloy and stainless steels, 17: 6661 (IPL-TR-32-222)
BOURGAREL, M. P., Shimming of isochronous cyclotron, 17: 7362
BOURGUIGNON, E., Prog. rpt. on intermetallic compounds, 7–9/61, 17: 6643 (BBC-112)
BOWEN, H. J. M., Effects of γ radiation on plant yields, 17: 5827
BOWMAN, G. G., Effects of nuclear explosions on ionosphere, 17: 6278
BOYARKINA, A. N., Fast nucleon reactions with light nuclei, 17: 7188
BOYARKINA, A. N., Interaction of fast nucleons with light nuclei, 17: 7209
BOYD, Elizabeth, Damage of chromosomes by doses of radioiodine, 17: 5845
BRADEN, C. H., Beta-γ directional correlations in Re-186 and Tm-170, 17: 7218
BRADEN, C. H., Beta-γ directional correlation in Re-188, 17: 7223
BRADLEY, Richard C., Final rpt. on solid surface investigation, 3/1/62, 17: 6634 (AFOSR-2273)
BRAGINA, A. N., Radioactivity of soil, 17: 6288
BRAID, T. H., Studies of pickup reactions, 17: 6780 (ANL-6603(p.52-5))
BRANDOW, B. H., Reference spectrum method for nuclear matter, 17: 7214
BRANDT, John C., Interplanetary gas. VII., 17: 6909
BRANSON, L. K., Gas discharge Cs ion source, 17: 6900
BRAUN, Heribert, Increase of ability of rats after irradiation, 17: 5934
BRAUNSFURTH, J., Rotation levels of Er-168, 17: 7270
BREEN, J. E., Application of external energy absorbers to large fission product shipping casks, 17: 6362
BREHM, R. L., Temperature coefficients in SNAP reactors, 17: 7560 (NAA-SR-7140)
BRENNAN, J. G., Partial and total capture probabilities of μ^- by C-12, 17: 6986
BRENNER, M. W., Proton groups from $S^{34}(d,p)S^{35}$, 17: 7247
BRENNER, Raul, Delayed time selector, 17: 6435 (IEA-50)
BRETON, D., Action of Sr ions on heart, 17: 5686
BREUER, Heinz, Radiation effects on glucose and fatty acid transport in small intestine, 17: 5933
BREWER, Leo, Thermodynamic stability and bond mechanisms in relation to electronic structure, 17: 6686 (UCRL-10012)
BRINK, Gilbert O., Ionization of He and Ar by electron impact, 17: 6805 (UCRL-6702)
BRINKMAN, Carl A., Mercury-203 labeled neohydrin, 17: 5841
BRITT, R. D., Jr., Colorimetry analysis in low parts per billion range, 17: 5977 (TID-15070)
BRIXNER, B. B., Reflecting microscope for temperatures to above 2500°C, 17: 6406 (TID-13148)
BRIZZI, E., Seminal vesicle of irradiated castrate adult rats, 17: 5796
BROIDO, A., Fall velocity of fallout particles, 17: 6303 (AD-276121)
BROKSH, V. R., Dosimeter for x- and γ radiation, 17: 6471
BROOKS, E. J., Distribution of Ca in epiphyseal cartilage, 17: 5727
BROWN, D. P., Radiation monitor and analyzer, 17: 6433 (HW-71354)
BROWN, D. P., Transistorized count-rate-meter, 17: 6432 (HW-66899)
BROWN, J. E., Prog. rpt. on reactor development, 4–6/62, 17: 7546 (HW-74761)
BROWN, Sanborn C., Microwave emission from non-Maxwellian plasmas, 17: 7469
BROWN, W. M. Court, Assessment of radiation hazards, 17: 6330
BRU, Andre, Protection of yeast cells against x radiation, 17: 5919
BRUECKMANN, H., Ferroelectric modulators, 17: 7413
BRUGGER, H., Decays of the ω and η mesons, 17: 6998
BRUGGER, H., Pion resonances in π^+-p interactions, 17: 6997
BRUGGER, Robert M., Neutrons and phonons, 17: 7068
BRUINSMA, P., University of Michigan 83-inch cyclotron. III., 17: 7366
BRUNELLI, B., Plasma research, 17: 7440
BRUSSEL, M. K., Beam extraction from Univ. of Illinois cyclotron, 17: 7403
BRYANT, D. A., Solar flare of September 28, 1961, 17: 6921
BRYANT, F. J., Determination of Sr-90 in human tissue, 17: 5714
BRYANT, J., Standardizing radioactive materials, 17: 6451
BRYHN-INGEBRIGTSEN, K., Measurement of neutron densities, 17: 6474
BUCHAL, Robert N., Solutions of exterior boundary value problems for wave equation, 17: 6503 (TID-14920)
BUCHANAN, W. Watson, Damage of chromosomes by doses of radioiodine, 17: 5845
BUCHWALD, N. A., Detection of x rays by the rat, 17: 5857
BUCKINGHAM, J. S., Analysis of Np, 17: 6025
BUCKLEY, John D., Deterioration of calcia-stabilized ZrO_2, 17: 6667 (NASA-TN-D-1595)
BUGRYSHEV, P. F., Effect of Sr and F on hemopoiesis in rats, 17: 5822
BUNGARDT, Karl, Phase interfacial processes in Zr–N alloys, 17: 6724
BURCHILL, P., Gas production from γ irradiation of sugar syrups, 17: 6142
BURG, J., Separation of metals by focusing ion exchange, 17: 6180 (IA-769)
BURGERJON, J. J., University of Manitoba cyclotron, 17: 7368
BURKE, J., $\alpha \rightleftharpoons \beta$ Phase transition in pure U, 17: 6713
BURLEIGH, R[ichard] J., Costs for Berkeley cyclotron, 17: 7415
BURLEIGH, R. J., Trim-coil construction for Berkeley cyclotron, 17: 7407
BURLEIGH, Richard J., Ion source mechanism for 88-inch cyclotron, 17: 7348 (UCRL-10068)
BURNHAM, J. B., Jr., EURATOM PuO_2–UO_2 test elements, 17: 7544 (HW-71232)
BURNS, R. E., Materials for reactor fuel dissolvers, 17: 6566 (HW-SA-2307)
BUROV, V. A., Ultrasonic splitting of Mössbauer line in $Sn^{119}O_2$, 17: 6889
BURR, J. G., Radiolysis of *o*-terphenyl with α particles, 17: 6139
BURROWS, W. H., Prog. rpt. on polymers, 6/62–8/62, 17: 5941 (TID-17239)
BUSEV, A. I., Determination of Os in presence of Ru, 17: 6014
BUSH, C. F., Determination of Fe in Zr and its alloys, 17: 5946 (AERE-AM-91)
BUSLER, W. R., Radiation polymerization of cyclopentadiene at −78°, 17: 6149
BUSSE, E., Nuclear industries of FORATOM countries, 17: 7579
BUSSELMAN, G. J., Plutonium value in fast oxide breeder, 17: 7545 (HW-

72304)
BUSTAD, L. K., Reproductive performance of swine ingesting Sr-90, 17: 5700 (HW-74969)
BUSTAD, Leo K., Thyroid adenomas in sheep fed I-131, 17: 5768 (HW-SA-2493)
BUTI, B., Relativistic effects on plasma oscillations. II., 17: 7463
BUTI, B., Relativistic effects on plasma oscillations. I., 17: 7462
BUTLER, S. T., Deuterons from high-energy proton bombardment, 17: 7258
BUTLER, S. T., Model for meson production in high-energy N-N collisions, 17: 6984
BUTTERWORTH, J. S., Phosphorus-32 recoils in KCl crystals, 17: 6160
BUTTINELLI, D., Recrystallization of Zn by thermal cycling, 17: 6698 (NP-tr-929)
BUTTS, W. R., Oxidation protective coatings for W alloy, 17: 6563 (DC-61-7-6)
BUZZI, G., Cesium-137 characteristics and therapeutic indications, 17: 5697

C

CABANNES, François, Luminous phenomena accompanying ionized gas explosion, 17: 7443
CABRESPINE, A., Shimming of isochronous cyclotron, 17: 7362
CACCIARI, I., Effects of tritiated H_2O on *Rhodotorula gracilis*, 17: 5719
CADY, Howard H., Crystallographic data, 17: 6116 (TID-14533)
CAGLIOTI, Giuseppe, Scattering of neutrons in solids, 17: 7070
CAHN, J. H., Electronic thermal conductivity in magnetoplasmas, 17: 7468
CAIN, Ray E., Optimizing programming effort through machine processing, 17: 5654 (HW-SA-2502)
CALKINS, V. P., Radiation damage to non-metallic materials, 17: 6750 (TID-17382)
CALLENDER, Sheila, Extracorporeal irradiation of the blood, 17: 5847
CALVO, W., Widening Bragg peak in path of charged heavy particles in tissue, 17: 5766 (BNL-5538)
CAMACHO, E. Bermudez, Prospecting for U, 17: 6284
CAMERON, A. E., Report of International Commission on Atomic Weights (1961), 17: 6072
CAMERON, W. D., Analog computers in nuclear processes, 17: 6496 (HW-SA-2552)
CAMPBELL, I. G., Phosphorus-32 recoils in KCl crystals, 17: 6160
CAMPBELL, J. E., Steels for rocket-motor cases, 17: 6651 (DMIC-178)
CAMPBELL, Ronald Hugh, Improvements in reactors, 17: 6489
CAMPBELL, W. M., Jr., Chloro complexes of nitrosylruthenium, 17: 6051 (TID-15360)
CANER, B., Geomagnetic observation of high-altitude nuclear detonation, 17: 6283
CANTIENI, E., Magnetoacoustic resonance in cylindrical plasma, 17: 7447
CANTOR, Stanley, Freezing point depressions in NaF, 17: 6088
CANUT, M. L., Thermal agitation in molecular crystals, 17: 6062
CAPELLEN, J., Absolute abundance of Cr isotopes in secondary minerals, 17: 6257 (IS-438)
CARBONNIER, R., Separation of isotopes, 17: 6492 (CEA-tr-A-1161)
CARDEN, A. E., Thermal fatigue, 17: 6674 (ORNL-TM-405)
CARE, A. D., Absorption of Mg-28 in sheep, 17: 5737
CARLONI, Q. C., Mannesmann rotary piercing of U, 17: 6594 (BRB-66)
CARLSON, H. L., Computer program for orbit stability in circular accelerators, 17: 7345 (TID-15535)
CARLSON, Roland W., Scintillator component, 17: 6491
CARLTON, Terry S., Freezing point depressions in NaF, 17: 6088
CARNAHAN, D. R., Extrusion of refractory alloys, 17: 6589 (ASD-TDR-62-670)
CARNEVALE, Edmund H., Preparation and properties of kryptonates, 17: 6364 (NYO-9720)
CARPENDER, W[illion] P., Services for Berkeley cyclotron, 17: 7414
CARPENTER, L. G., Prog. rpt. on hydrazine process development, 8–10/62, 17: 6123 (AGN-AN-756)
CARR, T. E. F., Movement of Sr in body, 17: 5712
CASALI, F., POLLY—one group Fermi age, 17: 6495 (CNEN-140)
CASHEN, William Stephen, Sampling apparatus for obtaining graphite specimens from reactors, 17: 7593
CASPARI, M. E., X-ray-induced strain and coloration in KCl, 17: 6866
CASTLEMAN, A. W., Jr., Chemical and physical behavior of released fission products, 17: 6174
CASWELL, R. S., Energy dependence of proportional counter neutron dosimeter, 17: 6477
CAUSSE, René, Putting electroconductive liquid in turbulence, 17: 7442
CAWSE, P. A., Effects of γ radiation on plant yields, 17: 5827
CAZEMAJOU, Jean, Neutron fluctuations of Ulysee reactor, 17: 7638
CECIO, A., Irradiation of pubertal and prepubertal mice, 17: 5795
CECIO, A., Ocular hypertonia induced by x irradiation, 17: 5794
CEDERLUND, J. F., Whole-body scanning in medicine. I., 17: 5684
CELEGHINI, E., Form factors of K_{e3} decay and kaon production, 17: 6953 (LNF-62/89)
CELLINI, R. F., Extraction of U from solutions of uranyl carbonate, 17: 6198
CERASUOLO, G., Irradiation of pubertal and prepubertal mice, 17: 5795
CERVELLATI, R., Neutron thermopiles for flux measurement in reactors, 17: 6485
CHALKE, H. D., Radiation and health, 17: 5906
CHAMBERLAIN, Owen, Antiproton-nucleon cross sections, 17: 6959 (UCRL-9288(Rev.))
CHAMBERS, Edmund S., "Protography" with MoO_3: method of H detection, 17: 6409 (UCRL-6793)
CHANDRA, Girish, Orientation of Co-60 in alloy of Co and Fe, 17: 7115 (NP-12330(p.179-85))
CHANDRASEKHAR, B. S., Electron cloud annealing furnace, 17: 6218
CHANG, Chieh Chien, Equilibrium of electron beam in plasma, 17: 7424 (DCAS-TDR-62-42)
CHANG, R., Properties of U carbide and BeO, 17: 6554
CHAPELLIER, Maurice, Measurement of dynamic nuclear polarization, 17: 7164
CHARLESBY, A., Sulfur as protecting agent against radiations, 17: 5923
CHASE, C. E., Critical velocities in liquid He II, 17: 6852
CHASSAGNE, D., Yttrium-90 needles in interstitial β therapy, 17: 5695
CHATTERJEE, A., Directional neutron counter for fast neutrons, 17: 7118 (NP-12330(p.199-201))
CHATTERJEE, A., Nonelastic scattering of 14-Mev neutrons, 17: 7096 (NP-12330(p.66-70))
CHATTERJEE, R., Radioprotective efficacy of cysteamine, 17: 5858
CHAVET, Isaac, Gamma spectra and periods of Hf-170, 171 and Lu-170, 171, 17: 7162
CHEKANOV, V. N., Lifetime of the level 4^+ (1282 kev) of Cd-114, 17: 7283
CHEN, Francis F., Electrostatic turbulence in a reflex discharge, 17: 7471
CHEN, Francis F., Sheath criterion, 17: 7425 (MATT-77)
CHEN, Joseph C. Y., Electron scattering by molecules, 17: 7076 (BNL-5801)
CHEN, Joseph C. Y., Electron capture by molecules, dissociative attachment, 17: 6862
CHEN, M. M., Power plant consideration for arc-jet propulsion system, 17: 7649
CHENEY, D. M., Impurity content determination of U and high-U alloys, 17: 6528 (TID-7625(p.45-51))
CHIANG, Y., Proton transfer in aqueous solution, 17: 6121
CHIKALLA, T. D., Irradiation of UO_2–PuO_2 capsules, 17: 6745 (HW-SA-2675)
CHILDS, Charles B., Disintegrations produced by 1.55-Bev protons, 17: 7261
CHILDS, Donald S., Jr., Sarcoma complicating fibrous dysplasia, 17: 5866
CHINAGLIA, B., Applications of short-lived radionuclides in activation analysis, 17: 6031
CHINOWSKY, William, Spin of the K^* resonance, 17: 7000
CHIRIBOGA, Jorge, Radiometric analysis of metals, 17: 5992
CHITANI, Toshizo, Absorption of H, and D, by Ti, 17: 6699 (SCL-T-451)
CHIZHOV, V. P., Deuteron emission in photodisintegration of O-16, 17: 7295
CHLECK, David, Preparation and properties of kryptonates, 17: 6364 (NYO-9720)
CHODURA, R., Energy yield of electrons and x rays in theta pinch, 17: 7478
CHOLLET, L., Structural hardening of Cu–Be alloys, 17: 6710
CHOSE, A. M., Nonelastic scattering of 14-Mev neutrons, 17: 7096 (NP-12330(p.66-70))
CHRISTENSEN, E. L., Anion-exchange separation of Pu and Th, 17: 6187

(TID-14598)
CHRISTENSEN, J. A., Movement of fission fragments and Pu in UO, irradiation tests, 17: 6742 (HW-SA-2309)
CHRISTENSEN, L. J., Lifetimes of excited nuclear states, 17: 6958 (UCRL-7091)
CHRISTOPHE-MICHEL-LEVY, M., Artificial reproduction of Zr minerals, 17: 6282
CHRISTY, Robert F., Hydrogen ionization zone of giant stars, 17: 6904
CHU, C. K., Steady MHD flow past non-conducting wedge, 17: 6898
CHUBAKOVA, O. V., Monitoring fuel element integrity, 17: 7583
CHURCHILL, S. W., Natural convection, 17: 6233
CHURCHILL-DAVIDSON, I., Advances in radiotherapy, L., 17: 5871
CIAMPELLI, L., Morphology of "drumsticks" in the rabbit, 17: 5798
CIAMPELLI, L., Rabbit "drumsticks" after pan irradiation, 17: 5797
CIMBLERIS, Borisas, Pulsing reactor, 17: 7639
CIOFFI, L. A., Electrophoretic study of irradiated fibrinogen, 17: 5799
CIUFFOLOTTI, L., Applications of short-lived radionuclides in activation analysis, 17: 6031
CLADIS, J. B., Trapped electrons injected by nuclear detonations, 17: 6839
CLAPHAM, W. F., Measurement of γ-emitting isotopes in feces, 17: 5734
CLARK, D., Material for ion propulsion, 17: 6544
CLARK, David J., Design of U.C.L.A. cyclotron, 17: 7353
CLARK, Hugh K., Interaction of fissionable units, 17: 6942 (TID-15342)
CLARK, John W., Rate of recovery from radiation injury, 17: 5909 (TID-14019)
CLARK, W. E., Gas sampling experiment in connection with Tamalpais event, 17: 5937 (ORNL-TM-445)
CLAUSS, F. J., Friction phenomena in space, 17: 6548
CLENDENEN, Larry, Fuel inspection by γ counting, 17: 7573 (UCRL-6621)
CLIFFORD, C. E., Models for γ shielding studies, 17: 7497 (DRCL-364)
CLINE, C. L., Brazing Be for aerospace applications, 17: 6607
CLINE, T. L., Solar flare of September 28, 1961, 17: 6921
COATES, D. W., Sea-level momentum spectra of muons, 17: 6918
COBB, H. R. W., Welding of Zr and Zr alloys, 17: 6630
COFIELD, R. E., *In vivo* γ spectrometry for inhalation studies, 17: 5704 (TID-12790)
COHEN, Saul G., Photochemical and radiation-induced reactions, 17: 6146
COHN, S. H., Metabolism of fission products in man, 17: 5699 (BNL-6503)
COHN, S. H., Turnover of Fe and vitamin B_{12}, 17: 5746
COLEBY, B., Treatment of meats with radiations. X., 17: 6367
COLEMAN, Paul J., Jr., Hydromagnetic waves in geomagnetic field, 17: 6926
COLES, Harold John, Nuclear steam generating plant, 17: 6225
COLGATE, Stirling A., Thermonuclear plasmas, 17: 7448
COLLEY, D., Decays of the ω and η mesons, 17: 6998
COLLEY, D., Pion resonances in π^+-p interactions, 17: 6997
COLLINS, John F., Cladding alloys for reactor applications, 17: 7571 (TID-17402)
COLLINS, Kenneth E., Radiation chemistry of solid hexabromoethane, 17: 6150
COLLINS, William R., Jr., Prog. rpt. on fallout, 9–12/62, 17: 5751 (HASL-132)
COLLO, G., Post-irradiation proctitis, 17: 5893
COLVIN, Donald W., Leak detector for T, 17: 6390 (DP-198)
COMAR, C. L., Absorption, excretion, and retention of Sr by babies, 17: 5730
COMAR, C. L., Bibliography of Sr and Ca metabolism, 17: 5747
COMISAR, G. G., Collisional damping of plasma oscillations, 17: 7460
COMPTON, V. B., Superconductivity of solid solutions of noble metals, 17: 6860
CONDAS, George A., Thermoelectric power of thin metallic films, 17: 6700 (UCRL-Trans-892(L))
CONDO, G. T., Nuclear structures from K^--meson absorption, 17: 7232
CONNER, Willard P., Jr., Nuclear fission in synthesizing organic compounds, 17: 6176
CONNORS, J. F., Power plant consideration for arc-jet propulsion system, 17: 7649
CONRAD, H. R., Effect of thyroidal I-131 release rates, 17: 5723
CONTOGOURIS, A. P., Regge poles and inelastic scattering at high energies, 17: 7513
CONTRERAS, Guillermo, Polymerization of ribomononucleotides by γ radiation, 17: 5791
CONWAY, W. A., Extinguishing of Pu fires, 17: 6321 (TRG-Report-342)
COOK, R. J., Electron spin resonance and applications, 17: 5692
COOKE, F. B., Friction phenomena in space, 17: 6548
COOPER, Alfred W., Electrostatic turbulence in a reflex discharge, 17: 7471
COOPER, M., Prog. rpt. on two-phase flow patterns with heat addition, 7–9/62, 17: 7613 (UNC-5042)
CORABOEUF, E., Action of Sr ions on heart, 17: 5686
CORCOS, G. M., Fall velocity of fallout particles, 17: 6303 (AD-276121)
CORENZWIT, E., Superconductivity of solid solutions of noble metals, 17: 6860
CORLEY, J. P., Lake storage lowering of river temperatures, 17: 6255 (HW-SA-2301)
CORLISS, Charles H., Experimental gf values for seventy elements, 17: 6824
CORNISH, J., Inner radiation belt and earth's magnetic field, 17: 6934
CORNUET, R., Application of short-lived tracers to flow-rate measurements, 17: 6376
CORREA, Jose N., Radiation treatment of pituitary adenomas, 17: 5840
CORSON, J. Mackie, Prog. rpt. on tissue transplantation, 6/61–5/62, 17: 5762 (AD-276039)
CORTH, Richard, Physical metallurgy of W, 17: 6688 (WADD-TR-60-37 (Pt.III))
CORTISONE, C., Cesium-137 characteristics and therapeutic indications, 17: 5697
CORYELL, C. D., Chemical consequences of β decay of Ce, 17: 6131 (TID-13363)
COSTEA, T., Radiolytic oxidation of p-xylene, 17: 6143
COSTIGAN, P., Resonant electron capture and stripping in Ne^+–Ne collisions, 17: 6863
COTLOVE, Ernest, Chloride content of fluids and tissues. I., 17: 5999
COTTON, F. Albert, Polarization of ligand-field spectra of planar chelate complexes, 17: 6115 (NYO-9868)
COTTRELL, W. B., Prog. rpt. on ANP Project, 3/10/53, 17: 7606 (ORNL-1515)
COUCOURDE, F., Radioprotection of the embryonic cell, 17: 5914
COULOMB, R., 100-Channel γ spectrometer in geology, 17: 6280
COULTER, Paul, Separation by ion exchange chromatography, 17: 5991
COUPLAND, J. H., Design of AERE 70-inch spiral ridge cyclotron, 17: 7374
COURANT, E. D., Low-velocity traveling waves, 17: 7322 (BNL-6511 (p.171-3))
COURANT, E. D., Possible deuteron acceleration, 17: 7335 (BNL-6511 (p.289-93))
COWHERD, C., Jr., Kinetics of fast interfacial reactions, 17: 6584
COWING, Russell F., Radiological safety in laboratory, 17: 6319 (TID-15445)
COX, A. J., Operation of 40-inch cyclotron, 17: 7354
COX, F. G., Welding Ta, Nb, Mo, and W, 17: 6631
COX, M. D., Local heat-transfer coefficients in nuclear reactor, 17: 6236
CRAGLE, R. G., Ultrafiltrable Ca-45 and P-32 in milk synthesis, 17: 5722
CRAIG, James A., Thermodynamic measurements using optical absorption in metal vapors, 17: 6802 (TID-17348)
CRANE, M., Prog. rpt. on two-phase flow patterns with heat addition, 7–9/62, 17: 7613 (UNC-5042)
CRAUSSE, Etienne, Putting electroconductive liquid in turbulence, 17: 7442
CREMER, Hans H., Compton spectrometer, 17: 6438 (TID-15530)
CRESPI, Maria Alicia, Air tightness of nuclear vessels and buildings, 17: 6210
CRESWELL, C. J., Strengths of H bonds, 17: 6120
CREWS, J. C., Scattering of He and A from cleavage plane of LiF, 17: 6794 (K-1498)
CREWS, R. Wayne, Brazing thin Be windows, 17: 6605
CRIEGEE, L., Determination of ρ,γ,π coupling constant, 17: 7001
CRONKITE, E. P., Turnover of Fe and vitamin B_{12}, 17: 5746
CROSBY, G. A., Spectroscopic studies of rare earth chelates, 17: 6085
CROWE, Christopher, Thermal state of the earth, 17: 6294
CROWN, J. Conrad, Analysis of magnetogasdynamic generators, 17: 6796 (NP-12332)
CRUSSARD, Jean, Inelastic charge exchange of K^+ mesons, 17: 6966

CUCCHIARA, Orlando, Preparation and properties of kryptonates, 17: 6364 (NYO-9720)
CUMMING, J. B., Recoil study of $Al^{27}(p,3pn)Na^{24}$, 17: 7230
CUMMINS, J. D., Estimation of reactor dynamic parameters, 17: 7529 (AEEW-R-179)
CUNNINGHAM, B. B., Thermodynamics of the actinides, 17: 6105
CUPERMAN, S., Nonthermal impurity radiation from spherical plasma, 17: 7464
CURTIS, Howard J., Hazards of heavy primary cosmic rays, 17: 6305 (BNL-6501)
CUTHBERT, G., Determination of Sb and Co in Mg-base alloys, 17: 5960 (PG-Report-337)
CZEZEL, E., Regeneration of liver of x-irradiated rats, 17: 5854

D

DAHLIN, David C., Sarcoma complicating fibrous dysplasia, 17: 5866
DAISLEY, R. E., Cosmic ray equator from satellite data, 17: 6938
DALTON, J. C., Determination of β activity in neutron dosimeter, 17: 5958 (PG-Report-306)
DAMMIN, Gustave J., Prog. rpt. on tissue transplantation, 6/61–5/62, 17: 5762 (AD-276039)
DANGLE, R. L., Proton-oxygen differential scattering cross sections. III., 17: 7228
DANIEL, H., Electron orbits in magnetic β spectrometer, 17: 6436 (IS-476)
DANIEL, J. L., Electron microscopy laboratory, 17: 6657 (HW-SA-2550)
DANIELS, J., Afterglow ionization in hydromagnetic shock tube, 17: 7422 (AWRE-O-11/62)
DANIELSON, G. C., Electrical properties of tungsten bronzes, 17: 6658 (IS-433)
DANILOV, G. S., Short-range three-particle forces, 17: 7518
DANILOV, G. S., Three-body problem for short-range forces, 17: 7517
DANILYAN, G. V., Internal conversion pairs in thermal neutron capture in Gd, 17: 7182
DA PROVIDENCIA, J., Symmetries of nuclear rotational states, 17: 7206
DARCIS, L., Radiosensitivity of cervical uterine cancers. I., 17: 5869
DARCIS, L., Radiosensitivity of cervical uterine cancers. II., 17: 5870
D'ARCY, F. J., Detection of μ mesons by human eye, 17: 6932
DARDEN, E. B., Physical dosimetry in biological experiments with fast neutrons, 17: 6315 (ORNL-1559)
DARDEN, S. E., Polarization and angular distributions from $Be^9(p,n)B^9$, 17: 7246
DARLINGTON, Sidney, Vertical velocity computer, 17: 6505 (TID-17315)
DARRAS, Raymond, Oxidation kinetics of Mg, 17: 6577
DAS, H. A., Argonaut reactor for radioactivation, 17: 6030
DAVENPORT, W. B., Jr., Prog. rpt. on electronics, 6–8/62, 17: 6801 (TID-17303)
DAVIS, J. J., Accumulation of radionuclides by aquatic insects, 17: 5702 (HW-SA-2848)
DAVIS, L. R., Protons and electrons at 12 earth radii, 17: 6922
DAVIS, W. D., Small bakeable mass spectrometer, 17: 6379 (61-RL-2501G(Rev.))
DAVIS, W. L., Prediction of tensile properties, 17: 6691 (WAPD-T-1335)
DAVIS, William E., Nuclear fission in synthesizing organic compounds, 17: 6176
DAVISON, William Henry Thomas, Curing of silicones by irradiation, 17: 6769
DAVISSON, J. W., Status rpt. on thermoelectricity, 17: 6522 (NRL-Memo-1361)
DAYTON, Russell W., Prog. rpt. on civilian applications, 8/62, 17: 6511 (BMI-1593(Del.))
DE, P., Radioprotective efficacy of cysteamine, 17: 5858
DE ABREU, Manuel, Neutron cross sections of Pr, Yb, and Lu, 17: 7078 (IEA-51)
DE ACHA, A., Thermal agitation in molecular crystals, 17: 6062
DEAN, W. R., Biharmonic Green's function, 17: 6846
DEBEAUVAIS-WACK, M., Microdosage of Ra in solution, 17: 6003
DE BROGLIE, Louis, Rotator model of elementary particles in Minkowski space. I., 17: 6981
DE BROGLIE, Louis, Space-time model of particles in Minkowski space. II., 17: 6982
DE BROGLIE, Louis, Thermodynamics of isolated particles, 17: 6826
DEBUS, G. H., Isotopic composition of samples, from different B standards, 17: 6787 (EANDC(E)-36L)
DE CAMARGO MATTOS, Marieta, Neutron cross sections of Pr, Yb, and Lu, 17: 7078 (IEA-51)
DE CARVALHO, H. G., Nuclear fission induced by 600-Mev protons, 17: 7086 (NP-12319)
DE CELLES, Paul C., Quantization of baryon number and hypercharge, 17: 6946 (BNL-5726)
DEEM, H. W., Thermal radiative properties of materials, 17: 6650 (DMIC-177(Vol.I))
DEERING, R. A., Ultraviolet radiation and nucleic acid, 17: 5894
DEEVEY, Edward S., Natural radiocarbon measurements. VI., 17: 6298
DEEVEY, Edward S., Natural radiocarbon measurements. VII., 17: 6299
DE FOREST, Robert, Hall probe assembly for cyclotron magnet, 17: 7350 (UCRL-10085)
DE GANAHL, Charles F., Reactor and shield weights for CFRMR, 17: 7564 (PWAC-89)
DEGERING, Ed. F., Irradiation factor-dependency, 17: 6175
DE GREGORIO, G., Recrystallization of Zn by thermal cycling, 17: 6698 (NP-tr-929)
DE HALAS, D. R., Rates of thermal polymerization of polyphenyl compounds, 17: 6113 (HW-SA-2414)
DE HEER, F. J., Excitation processes in He, 17: 7263
DEINENKO, A. S., Proton scattering by B-10, 17: 7176
DEISS, W. J., Vaporization of U and U carbides, 17: 6110
DE LA CRUZ, Felipe, Preparation of P-32, 17: 6141
DEL DUCA, M. G., Biochemical fuel cell potentialities for space flight, 17: 5663
DELITSYNA, N. S., Changes in interoceptive system after exposure to x radiation, 17: 5887
DELL, George F., Jr., Final rpt. on total reaction cross sections, 17: 7144 (TID-17357(Pt.III))
DELONE, N. B., Sensitivity of liquids to radiation, 17: 6472
DEL VALLE, C. Jones, Prospecting for U, 17: 6284
DELYAGIN, N. N., Shifts of γ transition of Sn-119 in organo-tin compounds, 17: 7281
DEMEUR, M., Nuclear recoil effect on ionization, 17: 7154
DEMIDOV, A. M., Gamma and internal conversion spectra in Gd isotopes, 17: 7175
DENNING, R. M., Hardness of irradiated and non-irradiated diamond, 17: 6751 (TID-17406)
DE PACKH, D. C., Water-bag model of sheet electron beam, 17: 7450
DE PINHO, Alcou, Gamma radiation during decay $Th^{234} \rightarrow Pa^{234}$, 17: 7160
DERRIEN, Henri, Calorimeter for measurement of in-pile heat evolution, 17: 6386 (CEA-2190)
DESAI, U. D., Solar flare of September 28, 1961, 17: 6921
DE SALAMONCA LORENTE, Enriquez, Neutron flux, 17: 7063
DESHPANDE, M. D., Life time of first excited state of Sn-116, 17: 7110 (NP-12330(p.152-7))
DESHPANDE, R. Y., Concentration studies in plastic scintillators, 17: 7122 (NP-12330(p.220-3))
DE SOUZA, B. C., Isotopic exchange in Co(II)–Co(III) system in perchloric acid. II., 17: 6084
DESYATNIKOV, V. M., Device for opening metal container with radioactive isotopes, 17: 6214
DEUTSCH, F., Time lag of gas breakdown, 17: 6821
DEVANATHAN, V., Charged pions from nuclei, 17: 6975
DEVANEY, Joseph J., Hafnium cross sections and temperature dependence, 17: 7084 (LA-2763)
DEVANEY, Marjorie J., Hafnium cross sections and temperature dependence, 17: 7084 (LA-2763)
DEVARE, S. H., Decay of Eu-156, 17: 7108 (NP-12330(p.141-6))
DEVARE, S. H., First forbidden β spectra of Nd-147, 17: 7113 (NP-12330 (p.166-71))
DE VOE, James R., Vacuum distillation and radiochemical separations, 17: 6135
DE WAMES, R. E., Observing virtual localized modes, 17: 6879
DEXTER, W. L., Oscillator and magnet power supplies, 17: 7412
DEZSI, Zoltan, Uranium, Ra, and Ra emanation contents of natural waters, 17: 6293
DHARMATTI, S. S., Quadrupole coupling constants of Na-23 and B-11, 17: 7127 (NP-12330(p.295-301))

DICKE, R. H., Earth and cosmology, 17: 6300
DICKENS, J. Kirk, Scattering of 31.1-Mev protons by C-12, 17: 7243
DICKERSON, Ronald F., Fission-product-release measurement from clad fuel, 17: 6645 (BMI-1604)
DICKERSON, Ronald F., Prog. rpt. on civilian applications, 8/62, 17: 6511 (BMI-1593(Del.))
DICKINSON, R., Determination of Sb and Co in Mg-base alloys, 17: 5960 (PG-Report-337)
DICKINSON, R. W., Advanced Na-cooled power stations, 17: 7622
DICKINSON, R. W., Sodium graphite reactor power plant, 17: 7623
DIEBNER, K., German industry for construction of reactors, 17: 7582
DI FERRANTE, Elvira R., Studies on Ra^{226}, Po^{210}, and Th^{228} in bones and teeth, 17: 5705 (TID-14604)
DILLON, R. L., Corrosion in nuclear reactors, 17: 6567 (HW-SA-2745)
DINGWELL, I. W., Computer program for thin-shell problem, 17: 6507
DIX, D. M., Macroscopic equations of partially ionized gases, 17: 6786 (DCAS-TDR-62-133)
DIXON, P. H., $\alpha \rightleftharpoons \beta$ Phase transition in pure U, 17: 6713
DLOUHY, Zdenek, Decontamination of metal surfaces, 17: 6343
DMITRIEV, I. S., Excitation of Be-8 in $Li^7(p,\alpha)He^4$, 17: 7179
DOBOS, S., Effect of casein on incorporation of Sr, 17: 5745
DOBRY, T., Hazards rpt. on PM-3A, 17: 7605 (MND-M3A-2496-II(Add.))
DOBRYAKOVA, L. A., Transport of organic plant substances, 17: 5756
DOBYNS, Brown M., Anomalies in chromosomes following large doses of I-131, 17: 5836
DOLINSKII, E. I., Feynman amplitudes for nonrelativistic processes, 17: 7524
DOLS, Charles G., Beam phase of 88-inch cyclotron, 17: 7349 (UCRL-10070)
DOMANGE, Louis, Oxytellurides of rare earths, 17: 6068
DOMINGUEZ, German, Preparation of P-32, 17: 6141
DOMOKOS, G., Asymptotic behavior of vertex part in meson theory, 17: 7505
DONALDSON, David M., Growth of tumors in mice iniected with x-irradiated cells, 17: 5824
DORST, J. H., Magnetic measurements on Berkeley cyclotron, 17: 7373
DOSE, Klaus, Glycolysis hindrance in ascites tumor cells by x rays. II., 17: 5900
DOSTROVSKY, I., Product yields in Cu spallation by protons, 17: 7233
DOUGHERTY, J. E., Ferroelectric solid solutions prossessing relatively large spontaneous polarizations, 17: 6678 (TID-14508)
DOUGLASS, R. M., Ferroelectric solid solutions possessing relatively large spontaneous polarizations, 17: 6678 (TID-14508)
DOUIS, M., Chemical processing apparatus for radioisotopes of short half life, 17: 6169
DOVE, R., Plastic models in thermal stress studies, 17: 6247 (TID-17498)
DOVE, R. C., Circuitry and recording equipment used with variable-resistance metallic strain gages, 17: 6405 (SCTM-364-61(73))
DOWLEY, M. W., High-field gaussmeter for liquid He temperatures, 17: 6424
DRAGT, A. J., Attenuation of hydromagnetic waves in ionosphere, 17: 6913
DRAKE, S. P., Friction phenomena in space, 17: 6548
DRAYCOTT, A., High-temperature compatibility of austenitic stainless steel with CO_2, 17: 6560 (AAEC/E-98)
DRECIN, Gheorghe, Equations of relativistic magnetohydrodynamics, 17: 6829
DREIKORN, R. E., Prog. rpt. on thermodynamics of refractory compounds, 9-11/62, 17: 6045 (RAD-SR-62-251)
DREISBACH, L., Lipid composition of liver mitochondria from normal and irradiated rats, 17: 5772 (TID-13322)
DRESSER, D. L., Prog. rpt. on thermionic emitter, 2–5/62, 17: 6788 (EDR-2791)
DROBINSKI, J. C., Jr., Prog. rpt. on radiation effects in liquid H media, 4–6/62, 17: 6747 (NP-12364)
DROPESKY, B. J., Decay of fission product Sn and Sb isotopes, 17: 7139 (TID-14799)
DRUMMOND, J. E., Collective properties of plasmas, 17: 7490
DUBOC, Jean, Inelastic charge exchange of K^+ mesons, 17: 6966
DUBOIS, Monique, Electric conductivity of irradiated LiF, 17: 6760
DUBROVINA, Z. V., Relation between density of fallout and dust content of air, 17: 6285
DUCKWORTH, Henry E., Energy loss in condensed matter of H^1 and He^4, 17: 7157
DUCKWORTH, W. H., Sinterable MgO powders and ceramics, 17: 6590 (ASD-TDR-62-700)
DUELLI, B., Beam-phase measurement studies, 17: 7410
DUFF, B. G., Quenching of ortho-positronium in He, 17: 6882
DUGGAL, V. P., Neutron cross sections at thermal and subthermal energy, 17: 7128 (NP-12330(p.369-77))
DUKE, C. B., Optical-model analysis of proton scattering on O, 17: 7235
DUKE, F. R., Fused nitrates and nitrites, 17: 6080
DULANEY, Harry, Beta-γ directional correlations in Re-186 and Tm-170, 17: 7218
DULANEY, Harry, Beta-γ directional correlation in Re-188, 17: 7223
DULLEMOND, C., Applications of pololoay to stripping reactions, 17: 7255
DUMONT, M., Action of Sr ions on heart, 17: 5686
DUNCAN, Robert N., CVTR fuel capsule irradiations, 17: 6739 (CVNA-153)
DUNCAN, T. R., Decay of Eu-152, 17: 7203
DUNHAM, Stuart Burton, Condensation nuclei detector, 17: 6488
DUNLAP, Louise B., Determination of U(IV) in Na phosphate electrolyte, 17: 5990
DUPLAN, J. F., Cells conferring restorative activity on irradiated mice, 17: 5810
DURISCH, J., Polarization capacity of O, 17: 7064
DURISCH, J., Polarization capacity of Cu and Zr, 17: 7065
DUTREIX, J., Yttrium-90 needles in interstitial β therapy, 17: 5695
DUTTON, J. W. R., Filter and assay unit for airborne radioiodine isotopes, 17: 5754 (PG-Report-408)
DUVALL, Ronald N., Antiradiation compounds. I., 17: 5924
DUZHENKOVA, N. A., Radiation-induced chemical changes in tryptophan, 17: 6163
DWYER, O. E., Wall and bulk temperatures for fluids flowing in concentric annuli, 17: 6228 (BNL-6177)
DZHELEPOV, B. S., Conversion electron coincidences in Lu^{176m} decay, 17: 7180
DZHELEPOV, V. P., Polarization correlation C_{nn} and scattering amplitude moduli for pp scattering, 17: 6949 (JINR-D-1073)

E

EBERHARD, Philippe, Inelastic charge exchange of K^+ mesons, 17: 6966
ECKER, G., Collective description and consequences for Landau damping, 17: 7459
ECKER, G., Lowering ionization energy for plasma, 17: 7458
ECKERSTIG, K., Gamma spectrum of Swedish Laplanders, 17: 5763 (AE-80)
ECKSTEIN, S. G., Negative pion capture in He, 17: 6979
EDGERTON, R., Emission spectra of KCl: Tl, KBr: Tl, and KI: Tl, 17: 6858
EDWARDS, R. R., Chemical consequences of β decay of Ce, 17: 6131 (TID-13363)
EDWARDS, Russell K., Chemical thermodynamics of materials at high temperature, 17: 6043 (NP-12310)
EFIMOVA, A. S., Cutaneous and visual analyzers following irradiation, 17: 5851
EFREMOV, V. Ya., Competing reactions involving radicals, 17: 6071
EGLI, Paul H., Direct energy conversion systems, 17: 6551
EGOROV, E. V., Radiation synthesis of ion-exchange sorbents, 17: 6140
EGOROV, L. B., Decay of mesic atoms of transition metals, 17: 6888
EHLERS, K. W., Ion source for Berkeley cyclotron, 17: 7406
ENNERT, A., Geomagnetic storm sudden commencement, 17: 6928
EICHLER, O., Decomposition in stored carrier-free NaI^{131} solutions, 17: 5693
EICK, Harry A., Thermodynamic properties of carbides, 17: 6052 (TID-17413)
EIDMAN, V. Ya., Attenuation of electromagnetic waves, 17: 7029
EISBERG, Robert, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
EKSTROM, F. E., Properties of U carbide and BeO, 17: 6554
ELINSON, S. V., Chemistry of Zr and Hf, 17: 6020
ELIOFF, Tommy, Antiproton-nucleon cross sections, 17: 6959 (UCRL-9288(Rev.))
EL KOMOSS, S. G., Energy-transfer and dissociation in excited molecules,

17: 6151
ELLEMAN, T. S., Short-lived isotopes in study of reactor fuel materials, 17: 7584
ELLIOTT, F., Filter and assay unit for airborne radioiodine isotopes, 17: 5754 (PG-Report-408)
ELLIOTT, Jack H., Semiconductor transmission-counter system, 17: 6440 (UCRL-10030)
ELLIOTT, Rodney P., Metallography of Nb–O and Nb–C alloys, 17: 6525 (TID-7625(p.8-19))
ELLIS, Frank, Modern radiobiology, 17: 5873
ELLIS, G. R. A., Cyclotron radiation from Jupiter, 17: 6912
ELPHICK, B. L., Afterglow ionization in hydromagnetic shock tube, 17: 7422 (AWRE-O-11/62)
ELSTON, L. W., Prog. rpt. on polymers, 6/62–8/62, 17: 5941 (TID-17239)
ELWYN, A. J., Neutron polarization and differential cross sections, 17: 6777 (ANL-6603(p.9-19))
EMERGY, D., Gas production from γ irradiation of sugar syrups, 17: 6142
ENDT, P. M., Investigation of $^{26}Mg(\alpha,\gamma)^{30}Si$ reaction, 17: 7262
ENFLO, Bengt, Deuteron vertex function anomalous threshold, 17: 6964
ENGELKE, C. E., n-p Total cross section at 0.4926 and 3.205 Mev, 17: 6976
ENGELMANN, C., Determining traces of impurities in Be, 17: 6027
ENGELMANN, F., Nonthermal impurity radiation from spherical plasma, 17: 7464
ENGELMANN, Jacques, Activity of γ emitters measured by ionization chambers, 17: 6431 (CEA-2036)
ENGLE, G. B., Evaluation of (Th,U)C_2, coated (Th,U)C_2 particles, and C coatings, 17: 6655 (GA-3067)
ENGLMAN, Robert, Adiabatic approximations and superconductivity theories, 17: 6867
ENJOJI, Hiroshi, Hot plasma produced by linear discharge device, 17: 7449
ENOMOTO, S., X-ray fluorescence spectrographic analysis using β source, 17: 5982 (CEA-tr-X-461)
EPSHTEIN, E. M., Conversion of electron-positron pair into μ-meson pair, 17: 7031
ERAMZHYAN, R. A., Neutral currents in neutrino experiments, 17: 7037
ERDAS, F., Spin correlation in muon pair production, 17: 6952 (LNF-62/75)
ERIKSSON, K. E., Internal bremsstrahlung, 17: 7152
ERMAKOV, V. S., Startup of first Belorussian reactor, 17: 7637 (JPRS-15345)
ERNEST, L. E., Beam extraction from Univ. of Illinois cyclotron, 17: 7403
ERWALL, L. G., Short-lived isotopes as tracers in industry, 17: 6372
ESPEJO, Romilio, Polymerization of ribomononucleotides by γ radiation, 17: 5791
ESTULIN, I. V., Gamma-γ coincidences in $Ag^{107}(n,\gamma)Ag^{108}$, 17: 7285
ETIEVANT, Claude, Instability and damping in beam-plasma system, 17: 7441
EVANS, D. F., Isotope shift in NMR spectra of H_2 and HD, 17: 6066
EVANS, E. A., Preparation of H^3-labeled atropine, 17: 6138
EVANS, Harold B., Determination of Rh, 17: 5985
EVESLAGE, Sylvester, Separation by ion exchange chromatography, 17: 5991
EWERTZ, H., Radiation dose rate at water surface in Merlin reactor, 17: 7633 (JÜL-73-RE)
EZER, E., Accumulation of colloidal Au in inflammations, 17: 5679

F

FADEEVA, V. I., Determination of Ti, Zr, Th, and Sc, 17: 6016
FAILLA, Patricia McClement, Radiation induced delay of cleavage in gametes, 17: 5895
FAIRBAIRN, H. W., Model of continent formation, 17: 6291
FALEEVA, Z. N., Influence of radiation-induced chromosomic aberrations on viability of cancerous cells, 17: 5890
FALLOWFIELD, T. L., Treatment of acutely x-irradiated mice, 17: 5917
FANALE, D. T., Oxygen content of organic materials, 17: 5993
FARLEY, Richard D., Voltage doubler rectifier, 17: 6400 (MATT-110)
FARR, Lee E., Hazards of radioactive fallout, 17: 6350
FARRELL, J. L., Rare earth lactates, 17: 6039 (IS-445)
FARRENKOPF, Ray protection for firemen, 17: 6326 (UCRL-Trans-838(L))
FASOLO, G. B., Applications of short-lived radionuclides in activation analysis, 17: 6031
FAURE, G., Model of continent formation, 17: 6291
FAUSKE, Hans K., Two-phase, one-component critical flow, 17: 6227 (ANL-6633)
FAY, H., Collector system for condenser banks of high-energy content, 17: 6397 (JÜL-72-PP)
FAY, H., Construction of condenser banks with low inductivity and high energy content, 17: 6396 (JÜL-71-PP)
FEATHERSTONE, R. P., Polarized proton source development, 17: 7341 (BNL-6511(p.335-7))
FEBER, R. C., Prog. rpt. on thermodynamics of refractory compounds, 9-11/62, 17: 6045 (RAD-SR-62-251)
FECHTER, H., Electromagnetic inflector for synchrotron injection, 17: 7416
FEDER, B. H., Detection of x rays by the rat, 17: 5857
FEDOROV, N. F., Solid solutions of La orthosilicates, 17: 6101
FEDOROV, V. V., Threshold singularities in total cross sections, 17: 7033
FEDOTOV, S. G., Elastic properties of Al–Ti alloys, 17: 6709
FEENBERG, Eugene, Ground state of liquid He-4, 17: 6883
FEITKNECHT, J., Isotopic composition of Ru in meteorites, 17: 6289
FELDMAN, Martin, Observation of photomultiplier pulses with sampling oscilloscope, 17: 6468
FELDMAN, Myra S., Bibliography on determination of T, 17: 6035 (DP-511)
FELLOWS, J. A., Mannesmann rotary piercing of U, 17: 6594 (BRB-66)
FENSTER, Stanley, Coulomb scattering amplitudes, 17: 6974
FENYES, Tibor, Alpha radioactivity of medium-heavy nuclei, 17: 7199
FENYES, Tibor, Vacuum evaporator for preparing radioactive sources, 17: 6158
FER, F., Stability in sector-focused accelerators, 17: 7382
FERBEL, T., Isobar pairs in $\bar{p}$-p collisions, 17: 7002
FERRARO, J. R., Synergism in solvent extraction of di-, tri-, and tetravalent metal ions. V., 17: 6050 (TID-15323)
FERREBEE, Joseph W., Transplantation of marrow, 17: 5683
FERRELL, Richard A., Giant resonance dipole transitions in nuclei, 17: 7305
FERRINI, P. Rossi, Morphology of "drumsticks" in the rabbit, 17: 5798
FERRINI, P. Rossi, Rabbit "drumsticks" after pan irradiation, 17: 5797
FERRIS, L. M., Aqueous processing of Th fuels. II., 17: 6186 (ORNL-TM-420)
FETISOV, V. N., Level structure of (γ,d) reaction on light nuclei, 17: 7185
FETTWEIS, P. F., Isomerism of Ir-194, 17: 7201
FIEDELDEY, H., Surface absorption of low-energy neutrons, 17: 7212
FIEHMIG, Rolf-Wilhelm, Dose capacity measurements in environment of I-131 patients, 17: 6360
FIELD, E. J., Effect of x radiation upon development of encephalomyelitis, 17: 5801
FIELDS, H., Microwave emission from non-Maxwellian plasmas, 17: 7469
FILLNOW, Ronald H., Materials in Shippingport PWR, 17: 7615 (WAPD-T-1545)
FILONOV, V. S., Monitoring fuel element integrity, 17: 7583
FILOV, R. A., Ternary fission of U, 17: 7279
FINEMAN, J. C., Critical velocities in liquid He II, 17: 6852
FINKE, Robert C., Electron-bombardment ion rocket, 17: 7644 (NASA-TN-D-1457)
FINLAY, E. A., Birmingham radial-ridge cyclotron beam extraction, 17: 7402
FINNEMORE, D. K., Isotope effect in superconducting Ru, 17: 6872
FINSTON, H. L., Determination of C–H ratios by neutron scattering, 17: 5949 (BNL-5814)
FINTZ, Pierre, Angular distributions in $B^{11}(d,p)B^{12}$, 17: 7165
FINTZ, Pierre, Excitation curves and angular distributions in $N^{14}(d,p)N^{15}$, 17: 7159
FIRSCHING, F. H., Precipitation of La–Pr iodate, 17: 5986
FISHER, C. R., Prog. rpt. on Rb/Cs evaluation, 6–9/62, 17: 6635 (AGN-8069)
FISHER, L. B., Obtaining a polymer based on p-diethynylbenzene, 17: 6117 (SCL-T-446)
FIX, Richard C., Biological effectiveness of protons and α particles, 17: 5770 (MDC-TDR-62-3)
FLAHAUT, Jean, Oxytellurides of rare earths, 17: 6068

FLAMM, E., Nuclear vibrations, rotations, and the shell model. I., 17: 7220
FLAMM, E., Perturbation of a-γ angular correlations in Am-241, Am-243, and Cm-243, 17: 7219
FLANDERS, T. A., Circulating-fuel reactor control, 17: 7570 (PWAC-206)
FLEMING, D. M., Input and source impedance corrections in voltmeter standardization, 17: 6395 (HW-SA-2510)
FLESCH, G. D., Absolute abundance of Cr isotopes in secondary minerals, 17: 6257 (IS-438)
FLICK, F., Nuclear industries of FORATOM countries, 17: 7579
FLINN, P. A., Electron cloud annealing furnace, 17: 6218
FOEX, Marc, Separation of rare earth elements, 17: 6069
FOEX, Marc, Separation of Nd and Pr by distillation, 17: 6070
FOGLIA, Sebastien, Unloading device for reactors, 17: 7594
FOGLIO, M. E., Diffusion of thermal neutrons, 17: 7071
FOLDIAK, Gabor, Radiochemical thermal decomposition of petroleum products, 17: 6159
FOMIN, A. A., Alimentary fats under ionizing radiations, 17: 5821
FOMIN, P. I., Asymptotic representations of Green's functions and vertex function, 17: 7525
FONTAN, J., Specific gravity of H_2O–steam emulsion, 17: 6378
FORD, Gilbert C., Power supply and control circuit for ion-getter pumps, 17: 6219
FORD, Kenneth W., Magnetic moments of μ-mesonic atoms, 17: 7213
FORSBERG, H. G., Powder mixing with short-lived radioisotopes, 17: 6374
FORSBERG, H. G., Short-lived isotopes as tracers in industry, 17: 6372
FORTMAN, John, Separation by ion exchange chromatography, 17: 5991
FORTUNE, R. D., Determination of best value for primary ionization in track chambers, 17: 6785 (CERN-62-31)
FOSS, Martyn, Electromagnetic inflector for synchrotron injection, 17: 7416
FOSTER, R. F., Effect of chronic feeding of Sr^{90}–Y^{90}, 17: 5701 (HW-SA-2255)
FOUCHER, Roger, Gamma radiation during decay $Th^{234} \rightarrow Pa^{234}$, 17: 7160
FOUSEK, R. J., Capsules for irradiations in reactor, 17: 7630 (ANL-6554)
FOWLER, W. Beall, Jr., Valence band structure of AgCl, 17: 6053 (TID-17447)
FOX, C. W., Joining of refractory metals, 17: 6558
FOX, Raymond, Ion adsorption on metals, 17: 6803 (UCRL-6389)
FOYE, William O., Antiradiation compounds. I., 17: 5924
FRAAS, A. P., Designs for gas-cooled reactors, 17: 7607 (ORNL-2752)
FRADKIN, M. I., Charged particle intensity during space-ship flights, 17: 6935
FRAHN, W. E., Surface absorption of low-energy neutrons, 17: 7212
FRAISSARD, Jacques, Structure and properties of silica gel, 17: 6648 (CEA-2129)
FRANCIS, W. E., Attenuation of hydromagnetic waves in ionosphere, 17: 6913
FRANCO, L., Cesium-137 characteristics and therapeutic indications, 17: 5697
FRANCO-FERREIRA, E. A., Joining of refractory metals, 17: 6558
FRANKEN, A. J. J., Design of Philips AVF prototype, 17: 7363
FRANK-KAMENETSKII, D. A., Thermal conductivity of H plasma, 17: 7439
FRANTSESSON, A. V., Radiospectroscope limit sensitivity, 17: 6413 (SCL-T-449)
FRAUTSCHI, S. C., Regge poles and inelastic scattering at high energies, 17: 7513
FRAZER, B. C., Neutron diffraction studies of ferroelectrics, 17: 6647 (BNL-5747)
FREDERICK, C. L., Ultrasonic inspection of thick wall steel pipe, 17: 6243 (HW-74597)
FREDRICKS, R. W., Ambipolar diffusion of plasma in weak magnetic field, 17: 7454
FREEMAN, J. J., Spectroscopic studies of rare earth chelates, 17: 6085
FREEMAN, R., R-f fields in nuclear magnetic double resonance, 17: 6076
FREMSTAD, J. K., Cesium-137 in dried milk products, 17: 5752 (HW-SA-2337)
FRENCH, Norman R., Occurrence of isotopes in environment, 17: 5755 (UCLA-497)
FRENCH, Norman R., Radioactive I from nuclear tests, 17: 6322 (UCLA-499)
FRERE, R., Statistical theory of hot atom chemistry. II., 17: 6137
FRESHLEY, M. D., Irradiation testing of UO_2–PuO_2 PRTR fuel elements, 17: 6744 (HW-SA-2668)
FREY, W. F., Gamma intensity in decay of Ir-192, 17: 7151
FRIED, Ralph E., Deposition of Be-7 and P-32 precipitation, 17: 6840
FRIEDLANDER, G., Product yields in Cu spallation by protons, 17: 7233
FRIES, B. A., Gas flow measurements by total-count method, 17: 6366
FRIGERIO, Norman A., Prevention of spattering during high-temperature ignitions, 17: 5976 (TID-14592)
FRITZ, James S., Separation of Fe by liquid-liquid extraction, 17: 6183 (IS-423)
FROSCH, R., Improvement of coincidence method, 17: 6448
FROSCH, R. P., Electronic energy relaxation in the solids, 17: 6075
FRUEHAUF, K., Studies with radioisotopes in chemical process industry, 17: 6373
FRY, L. M., Prog. rpt. on fallout, 12/31/61, 17: 6272 (ORO-520)
FRYE, Robert L., Radioisotope scanning of precordial distribution of I, 17: 5685
FUENFER, E., Electron density and magnetic field distribution in theta pinch, 17: 7477
FUHS, A. E., Electric conductivity of arc plasma jet, 17: 7493
FUJIHARA, M. P., Antibiotic resistance and radiation induced mutation in *C. columnaris*, 17: 5769 (HW-SA-2540)
FUJII, A., Form factors of K_{e3} decay and kaon production, 17: 6953 (LNF-62/89)
FUNK, E. G., Jr., Lifetimes of 246- and 46.7-kev transitions in Po-210, 17: 7245
FURTH, H. P., Prevalent instability of nonthermal plasmas, 17: 7456
FURTH, Harold P., Thermonuclear plasmas, 17: 7448
FURUICHI, Akio, Hot plasma produced by linear discharge device, 17: 7449
FUTTERMENGER, W., Determination of γ attenuation factors of shielding materials, 17: 7501
FUZINA, E. K., Transport of organic plant substances, 17: 5756

G

GADD, J. D., Protective coatings for Nb alloys, 17: 6510 (ASD-TDR-62-934)
GADZHIEV, S. A., Polarization effects in decay of π mesons, 17: 7021
GAILLOUD, M., Isobar pairs in $\bar{p}$-p collisions, 17: 7002
GAL, O. S., Measurement of doses below 1000 rad, 17: 6453
GALKIN, G. N., Radiation defects in Si, 17: 6767
GALLANT, G. A., High-temperature remotely handleable cabling system, 17: 6208 (XDC-61-3-66)
GALLE, P., Yttrium-90 needles in interstitial β therapy, 17: 5695
GALLMANN, Andre, Excitation curves and angular distribution in $N^{14}(d,p)N^{15}$, 17: 7159
GALLMANN, Andre, Angular distributions in $B^{11}(d,p)B^{12}$, 17: 7165
GAL'TSOVA, R. D., Radiation effects on N metabolism in yeast cells, 17: 5881
GANDY, A., Measurement of activity of radionuclides, 17: 6455
GANGRSKII, Yu. P., Cascade Coulomb excitation of rotational levels, 17: 7290
GARCIA, J., Detection of x rays by the rat, 17: 5857
GARCZYNSKI, W., Nakanishi parametric representation, 17: 6965
GARDNER, Andrew L., Diagnostic measurements on P-4 steady-state plasma, 17: 7432 (UCRL-6562)
GARDNER, Andrew L., Steady-state plasma system, 17: 7431 (UCRL-6561)
GARDNER, L. R. T., End-fitting temperatures of fuel elements, 17: 7572 (TKG-Report-306)
GARDNER, R. P., Alpha gage for measurement of small density thicknesses, 17: 6422
GARELIS, Edward, Prog. rpt. on pulsed neutron application to reactor, startup, 17: 7541 (GEAP-4047)
GARRATT, P. G., Sulfur as protecting agent against radiations, 17: 5923
GARREN, A. A., Calculation of cyclotron trim-coil currents, 17: 7386
GARREN, A. A., Electrostatic deflector for Berkeley cyclotron, 17: 7404
GARREN, A. A., Geometry of Berkeley 88-inch cyclotron, 17: 7389
GASPAR, E., Radioactive tracers in study of subterranean water flow, 17: 6377
GAST, P. F., Reactor physics of Pu in H_2O, 17: 7558 (HW-SA-2529)
GAST, Paul F., Collision probabilities in spheres, 17: 7056 (HW-SA-2696)
GATES, D. W., Materials for plasma propulsion, 17: 6545

GATLAND, I. R., Analytic approximation to inverse amplitude dispersion relations, 17: 7510
GAUL, Horst, High mutation rate in barley, 17: 5861
GAUMER, R. E., Thermal control surfaces, 17: 6549
GAVRIN, P. P., Capture and containment of plasma, 17: 7485
GEBALLE, T. H., Superconductivity of solid solutions of noble metals, 17: 6860
GEBHARDT, Erich, Oxidation of U, 17: 6582
GEBHARDT, Erich, Rate of evaporation of Ta in vacuum, 17: 6726
GEDALIN, E. V., Electron-photon showers by high energy μ mesons, 17: 7044
GEEL, J., Design of Philips AVF prototype, 17: 7363
GELFAND, N., Decays of the ω and η mesons, 17: 6998
GELFAND, N., Pion resonances in π^+-p interactions, 17: 6997
GELTMAN, S., Absorption coefficient of H negative ion, 17: 6825
GENSHAFT, Yu. S., Diagram of state of Ce, 17: 6730
GEORGE, Roger, Inelastic charge exchange of K^+ mesons, 17: 6966
GERASIMOV, S. B., Scattering of neutrons by Coulomb field, 17: 7074
GERBER, G., Metabolism of saccharides after whole-body x irradiation, 17: 5828
GERBER, G. B., Metabolism of saccharides after whole-body x irradiation, 17: 5828
GERBER, R. C., Advanced Na-cooled power stations, 17: 7622
GERBERICH, W. W., Tensile properties of low-alloy and stainless steels, 17: 6661 (JPL-TR-32-222)
GERDAU, E., Rotation levels of Er-168, 17: 7270
GERJUOY, Edward, Collision cross sections and atomic scattering, 17: 6774 (AFCRL-531(I))
GERMANN, G., Gas production from γ irradiation of sugar syrups, 17: 6142
GERSCH, H. A., Quantum cell model for bosons, 17: 6993
GERSHANOVICH, V. N., Oxidative metabolism in *Staphylococcus aureus*, 17: 5790
GERSHTEIN, S. S., Neutral currents in neutrino experiments, 17: 7037
GESHKENBEIN, B. V., Hypotheses regarding nature of resonances, 17: 7048
GESLIN, M., Radioactivity of thermal waters, 17: 6281
GFELLER, Chr., Measurement limits of weak activity, 17: 6449
GHOSE, A. M., Directional neutron counter for fast neutrons, 17: 7118 (NP-12330(p.199-201))
GHOSE, A. M., Small-angle coherent scattering of γ rays, 17: 7111 (NP-12330(p.158-61))
GIANNARDI, G., Seminal vesicle of irradiated castrate adult rats, 17: 5796
GIBBONS, D., Short-lived radioactive isotopes in activation analysis, 17: 6029
GIBBONS, John F., BONUS reactor pressure vessel, 17: 7600 (GNEC-210-(Suppl.1))
GIBBS, W. R., Distorted wave Born approximation calculations, 17: 7170
GIBSON, G., Particle behavior in magnetic mirror geometry, 17: 7465
GIBSON, Gordon, Particle behavior in magnetic mirror and cusp geometries, 17: 7466
GIBSON, J. W., Critical magnetic fields of superconducting Mo, 17: 6857
GIESCH, M., Nanosecond high-voltage pulses for internal cyclotron beam deflection, 17: 7344 (CERN-62-25)
GILBERT, E. C., Rates of thermal polymerization of polyphenyl compounds, 17: 6113 (HW-SA-2414)
GILBERT, Nathan, Transfer functions of heat exchangers, 17: 6231
GILBERT, T. L., Distortion of atoms in polyatomic systems. II., 17: 6799 (TID-14708)
GILDENBURG, V. B., Polarizability of plasmoids, 17: 7482
GILL, P. S., Thermal neutron activation cross sections, 17: 7100 (NP-12330(p.95-6))
GILLESPIE, Arthur Blackley, Balanced electronic circuits, 17: 6428
GILLESPIE, James, Boundary layer resistance and sheath potential in shock tube, 17: 6899
GILLI, P. V., Manufacture of nuclear plant, 17: 7617
GILLILAND, R. G., Joining of refractory metals, 17: 6558
GINESTRA, Aldo La, Products formed by heating Ca and Th phosphates, 17: 6061
GINZBURG, V. L., Charged particle intensity during space-ship flights, 17: 6935
GIOVANNOZZI-SERMANNI, G., Effects of tritiated H_2O on *Rhodotorula gracilis*, 17: 5719
GISLON, R., Neutron thermopiles for flux measurement in reactors, 17: 6485
GITLESEN, Gunnar, Structure and properties of U–V–Mo, 17: 6725
GIVON, M., Anion exchange of metal complexes. XIII., 17: 6182 (IA-783)
GLASGOW, L. R., Trim-coil construction for Berkeley cyclotron, 17: 7407
GLASS, Neal W., Direct comparison of B-12 and N-12 β spectra, 17: 7141 (TID-15182)
GLEDHILL, J. A., Cape Town anomaly, 17: 6850
GLEDHILL, Peter Raymond, Charge/discharge systems for GCR, 17: 7585
GLEIT, C. E., Retention of tracers in dry ashing of blood, 17: 5716
GLEYVOD, R., Polarization capacity of O, 17: 7064
GLEYVOD, R., Polarization capacity of Cu and Zr, 17: 7065
GLIDDON, J. E. C., Decay of plane-stratified distribution of ionization, 17: 6933
GLUBRECHT, H., Determination of γ attenuation factors of shielding materials, 17: 7501
GLUCKSTERN, R. L., Feasibility of π-meson linear accelerator, 17: 7319 (BNL-6511(p.124-7))
GLYNN, C. E., Drilling hardened Astroloy, 17: 6617
GOBBI, B., Excited state lifetime measurements, 17: 6450
GODBOLE, E. W., Dissociation of deuterated ethyl and isopropyl acetates, 17: 6164
GODFREY, Graham Lewis, Balanced electronic circuits, 17: 6428
GODIN, V. P., Reactions of nervous system of irradiated animals, 17: 5889
GOEKE, Roscoe H., Radiological safety at Hardtack, 17: 6317 (OTO-58-3)
GOLAND, A. N., Electron-microscope observations in neutron-irradiated Cu and Au, 17: 6763
GOLAND, Allen N., Electron microscopy in observations of radiation damage, 17: 6746 (MRL-126)
GOLD, L. Peter, Molecular constants of Li hydride, 17: 6077
GOLD, Raymond, Gamma dose rate from neutron-induced activity in earth, 17: 6258 (NDL-TR-41)
GOL'DANSKII, V. I., Emission of delayed protons during positron decay, 17: 7169
GOLDBERG, H., Protonium two-meson annihilation, 17: 6947 (IA-768)
GOLDBERG, Leo, Abundance of He-3 in the sun, 17: 6911
GOLDEMBERG, J., Magnetic elastic scattering of electrons by light nuclei, 17: 7222
GOLDFINGER, P., Heats of vaporization of solids. I., 17: 6095
GOLDHABER, Gerson, Spin of the K^* resonance, 17: 7000
GOLDRING, G., Gyromagnetic ratio of 2^+ state of Os-188, 17: 7225
GOLDSTEIN, Gerald, Determination of Th^{**}, 17: 5995
GOLDSTEIN, N., Neutron and γ dosimetry in animal exposure volume at TRIGA, 17: 5780 (USNRDL-TR-583)
GOLDSZTEIN, M., Radioactivity of lava of Puys chain, 17: 6279
GOLDSZTEIN, M., 100-Channel γ spectrometer in geology, 17: 6280
GOLENETSKII, S. P., Detection and registration of radioactive aerosols, 17: 6287
GOLOVIN, B. M., Polarization correlation C_{nn} and scattering amplitude moduli for pp scattering, 17: 6949 (JINR-D-1073)
GOMBOSI, Eva, Nuclear interactions of 9-Bev protons in photographic emulsion, 17: 6971
GOMEZ, M. Barrachina, Production of I-132, 17: 6173
GOOD, M. L., Bending-magnet and quadrupole aberrations for paraxial rays, 17: 6782 (ANL-6611)
GOOD, Robert C., Jr., Destructive effects of plasmas generated by exploding wires, 17: 7495
GOODING, T. J., Instabilities in coaxial plasma gun, 17: 7494
GOODSPEED, F. C., Radiolysis of *o*-terphenyl with α particles, 17: 6139
GOODWIN, J. G., Prediction of tensile properties, 17: 6691 (WAPD-T-1335)
GOODWIN, Leslie E., Zircaloy cladding thickness testers, 17: 6391 (DP-663)
GOPALAN, K., Single-channel pulse-height analyzer, 17: 7120 (NP-12330 (p.209-13))
GOPINATHAN, K. P., Cross section for production of Nb isotopes, 17: 7101 (NP-12330(p.97-103))
GORCHAKOV, E. (Yu.) V., Inner radiation belt and earth's magnetic field, 17: 6934
GORDON, M. M., Field imperfection effects on stability in cyclotron, 17: 7383
GORDON, R. G., Magnetic susceptibility measurements of small samples.

II., 17: 6884
GORDON, V. I., Radiation safety in x-ray rooms, 17: 6361
GORICHEV, P. A., Nuclear structure in high-energy reactions with nuclei, 17: 7186
GORIZONTOV, P. D., Effect of radiation on heart, 17: 5782 (JPRS-15872)
GORODETZKY, Serge, Angular distributions in $B^{11}(d,p)B^{12}$, 17: 7165
GORODETZKY, Serge, Excitation curves and angular distribution in $N^{14}(d,p)N^{15}$, 17: 7159
GORSHKOV, V. G., Relativistic Coulomb scattering, II., 17: 7520
GOSNELL, J. W., Expanding vapor bubble in boiling liquid, 17: 6235
GRABOWSKI, Z., Search for two-quantum decay of In-114m, 17: 7210
GRAF, K. A., Electromagnetic waves at plasma boundary, 17: 7412 (AFCRL-62-186)
GRANOVSKII, V. L., Volume recombination in He plasma, 17: 7480
GRANOVSKII, Yu. I., Resonance interactions of K mesons, 17: 7043
GRANT, G. A., Protection of rat thymocytes irradiated *in vitro*, 17: 5922
GRANT, Nicholas J., Strenthening mechanisms of dispersion-strengthened alloys, 17: 6591 (ASD-TDR-62-734)
GRANT-TAYLOR, T. L., Radiocarbon age measurements. V., 17: 6295
GRASS, F., Gamma spectrometric studies on fallout, 17: 6346
GRAY, James, Jr., Neutron fission counter for nuclear and analytical measurements, 17: 6467
GRAY, R. G., Effects of burnup on ceramic fuel, 17: 6755
GRECHISHKIN, V. S., Relative intensities of NOR lines of Sb-121, 17: 7299
GREEN, R. M., Excretion of Cs-137 in humans, 17: 5713
GREENE, David, Effect of chamber size on measurements of x-ray beam, 17: 6445
GREENSTREET, M. E., Circulating-fuel reflector-moderated reactor, 17: 7568 (PWAC-189(Vol.1))
GREENSTREET, M. E., Circulating-fuel reflector-moderated reactor, 17: 7569 (PWAC-1.9(Vol.2))
GREENWOOD, R. C., Gamma decay of 4.4-min Rh-104m isomer, 17: 7226
GREENWOOD, R. C., Nuclear level scheme of Rh-104, 17: 7227
GRIBAUMONT, A., Nuclear transfer reactions. III., 17: 7155
GRIBOV, V. N., Amplitude attenuation for various processes, 17: 6894
GRIBOV, V. N., Regge fermion poles and asymptotics of meson-nucleon scattering, 17: 7034
GRIBOV, V. N., Regge poles and Landau singularities, 17: 7526
GRIBOVA, I. A., Analyzing peripheral blood in chronic action of radiations, 17: 5823
GRIFFITH, O. Hayes, Irradiated organic inclusion compounds, 17: 6162
GRIGORESCU, L., Radioactive tracers in study of subterranean water flow, 17: 6377
GRIGOROV, N. L., Antimatter in cosmic rays and outer space, 17: 6915
GRINELAND, B., Measurement of neutron densities, 17: 6474
GRIMM, A. C., Prog. rpt. on dielectric to metal seal technology, 3/19/62–6/31/62, 17: 6676 (RADC-TDR-62-401)
GRIN, G. A., Efficiency of detector shielding, 17: 7067
GRIN, G. A., Light yield of solution NE 213 to protons, 17: 6119
GRIN, Yu. T., Moments of inertia of heated nucleus and angular anisotropy of fission fragments, 17: 7301
GROMOV, B. A., Diffusion coefficients in polymers, 17: 5943
GROMOV, V. F., Radiation effect on combined acrylonitrile and ethylene polimerization, 17: 6166
GROMOV, Yu. D., Dosimeter for x- and γ radiation, 17: 6471
GROOM, D. E., 25-Input pulse-height recording system, 17: 6423
GROSHEV, L. V., Gamma and internal conversion spectra in Gd isotopes, 17: 7175
GROSS, Robert A., Hydromagnetic ionizing fronts, 17: 7433 (UCRL-9971)
GROSSE, A. V., Temperature range of liquid Pb and Ag, 17: 6711
GROUNES, M., Radiation effects in structural materials, 17: 6735 (AE-90)
GROVER, J. R., Product yields in Cu spallation by protons, 17: 7233
GRUEEBLER, W., Distorted wave Born approximation calculations, 17: 7170
GRUEEBLER, W., Measurement of 1st excited level of Na-21, 17: 7171
GRUENSTEIN, Margot, Irradiation and 3-methylcholanthrene administration in breast tumor, 17: 5839
GRUVERMAN, I. J., Neutron activation analysis of alloy steel, 17: 5984
GSCHNEIDNER, Karl A., Jr., Valences of Ce allotropes, 17: 6047 (TID-14535)
GUARINO, John P., Electron attachment and solvation in irradiated glasses, 17: 6148
GUENTHER, P., Improvements in pressurized water reactors, 17: 7616
GUERIN, R. A., Calcium-47 in the study of bone, 17: 5742
GUERNSEY, John B., Prog. rpt. on manufacturing Nb alloy sheet, 1–9/62, 17: 6593 (ASD-TR-7-784(VII))
GUEVEN, Binay, Isotopic and isotonic yields in nuclear fission, 17: 7085 (NP-12309)
GUILBAULT, P., Action of Sr ions on heart, 17: 5686
GUILLERMO, S., Radioactivity of lava of Puys chain, 17: 6279
GUILLOU, R. B., Galveston area seroradioactivity survey, 17: 6254 (CEX-62.6.1)
GUINN, Vincent P., Short-lived radioisotopes used in neutron activation analysis, 17: 6026
GUIZERIX, J., Application of short-lived tracers to flow-rate measurements, 17: 6376
GULIEV, N. A., Conversion of electron-positron pair into μ-meson pair, 17: 7031
GUNNING, A. J., Extracorporeal irradiation of the blood, 17: 5847
GUPPY, C. B., Computer program for derivation of transfer functions, 17: 7530 (AEEW-R-189)
GUPPY, C. B., Transfer function synthesis for reactor spatial dynamics, 17: 7531 (AEEW-R-197)
GUPTA, Ashis Sen, Flow of fluids through beds, 17: 6232
GUPTA, J. B., Neutron inelastic scattering cross sections in Pb isotopes, 17: 7099 (NP-12330(p.86-94))
GURDJIAN, E. S., Double collimator isotope detection of carotid blood flow, 17: 5732
GURIAN, Joan M., Effect of x rays on fission rate of Paramecium, 17: 5778 (TID-15521)
GUSAROV, I. I., Radioactivity of air and meteorological factors, 17: 6286
GUSEV, Yu. K., Lifetimes of excited states Dy-160, Lu-175, Hf-177, and Ir-191, 17: 7292
GUSKOVA, V. N., Radioactivity of soil, 17: 6288
GUST, William, Ion adsorption on metals, 17: 6803 (UCRL-6389)
GUSTAFSSON, S., Search for two-quantum decay of In-114m, 17: 7210
GUTH, Eugene, Theory of relativistic particle equations, 17: 6963
GUTHRIE, J. E., Radioactive factors in water pollution, 17: 6334

H

HAALAND, John, Mass spectrometric determinations of O-17 and O-18 in D_2O, 17: 5956 (KR-30)
HAAS, Richard E., X-ray barrier efficiency of building materials, 17: 6720
HAASBROEK, F. J., Extending range of "Fricke" dosimeter, 17: 6430 (BNL-763)
HABANEC, J., Polarization of protons scattered on C, 17: 7166
HADDEN, Richard John Bayley, Improvements relating to standard leaks, 17: 6427
HADDOCK, Fred T., Microwave radiation from planet Mercury, 17: 6907
HADDOCK, R. P., Pion factory in elementary particle physics, 17: 7391
HAEBERLI, W., Polarization of neutrons from (d,t) reaction, 17: 7066
HAEGEMAN-GELADI, G., Preparation of Te-132 and I-132, 17: 6172
HAESSNER, F., Cadmium tantalate as control material, 17: 6714
HAGEDOORN, H. L., Analog studies for an AVF cyclotron, 17: 7388
HAGEDOORN, H. L., Computer programs for an AVF Cyclotron, 17: 7387
HAGEDOORN, H. L., Design of Philips AVF prototype, 17: 7363
HAGEDOORN, H. L., Orbits in an AVF cyclotron, 17: 7381
HAGEMANN, Fronch, Neutron fission counter for nuclear and analytical measurements, 17: 6467
HAGIWARA, Shigeo, Microwave radiation from plasmas, 17: 7452
HAIN, K., Electron density and magnetic field distribution in theta pinch, 17: 7477
HAISSINSKY, M., Comparison of the chemistry of cis- and trans-uranides with La and transition metals, 17: 6090
HAJDUKOVIC, S., Effect of x radiation and cysteamine on barbiturate response, 17: 5788
HAKE, R. R., Transition metal alloy superconductors, 17: 6874
HALBWACHS, Francis, Rotator model of elementary particles in Minkowski space. I., 17: 6981
HALBWACHS, Francis, Space-time model of particles in Minkowski space. II., 17: 6982
HALE, Raymond W., Lithium—present and future in Canadian mining,

17: 6538
HALL, Dennis, Operation of 3-bit bubbling register, 17: 6499 (NP-12308)
HALL, E. J., Metal compensators for tissue heterogeneity in radiotherapy, 17: 5680
HALL, Elton H., Viscosity of saturated liquid K, 17: 6671 (NP-12366)
HALL, L. H., Boron hydrides in radiation-induced reactions in penta- and decaborane, 17: 6147
HALL, Lawrence S., Statistical theory of transport phenomena, 17: 6818
HALL, Lawrence S., Steady-state plasma system, 17: 7431 (UCRL-6561)
HALVORSON, H. O., Separation of labeled from unlabeled proteins, 17: 5710
HAMERSKI, D., Gas production from γ irradiation of sugar syrups, 17: 6142
HAMILL, William H., Electron attachment and solvation in irradiated glasses, 17: 6148
HAMILTON, J. H., Decay of Eu-152, 17: 7203
HAMILTON, J. H., Gamma intensity in decay of Ir-192, 17: 7151
HAMILTON, W. D., Internal bremsstrahlung, 17: 7152
HAMMANN, John W., Analog computer for quadrupole magnet design, 17: 7346 (TID-17429)
HAMMER, C. L., αZ correction to Bethe-Maximon pair production cross section, 17: 6948 (IS-429)
HANCOX, R., Triggering mechanism of low-pressure spark gaps, 17: 6217
HANER, David A., Scattering of 31.1-Mev protons by C-12, 17: 7243
HANKS, Charles W., Electron beam furnace with field guidance of electrons, 17: 6226
HANLE, W., Particle accelerators, 17: 7351
HANNA, S. S., Nuclear resonance absorption of γ rays, 17: 6778 (ANL-6603(p.20-46))
HANS, H. S., Interaction of 14.8-Mev neutrons with Al, 17: 7093 (NP-12330(p.39-45))
HANSEN, Niels, Bibliography on dispersion-strengthened materials, 17: 6677 (RISÖ-48)
HANSEN, Robert S., Adsorption of hydrocarbons on clean Ir, 17: 6660 (IS-462)
HANST, P. L., Prog. rpt. on thermodynamics of refractory compounds, 9-11/62, 17: 6045 (RAD-SR-62-251)
HANSTOCK, Raymond Ford, Ultrasonic testing of materials, 17: 6250
HARDEN, F. D., Creep test apparatus for use with explosives, 17: 6242 (AWRE-O-34/62)
HARDENBERGH, D. E., Nozzle connections of pressure vessels. I., 17: 6246 (NYO-10147)
HARDER, Dietrich, Dose distribution by horizontal motion of telecobalt apparatus, 17: 6357
HARDIE, G., Proton-oxygen differential scattering cross sections. III., 17: 7228
HARDING, R. S., Prog. rpt. on nuclear superheater, 7–9/62, 17: 7601 (GNEC-254)
HARDTKE, Fred C., Thermoelectricity in irradiated glass, 17: 6766
HARDY, Edward P., Jr., Prog. rpt. on fallout, 9–12/62, 17: 5751 (HASL-132)
HARLOW, Francis H., Fluid dynamics calculation, 17: 6230 (TID-14550)
HARRIES, W. L., Ion drift velocity in EM fields, 17: 7426 (MATT-92)
HARRIS, David L., Nuclear spins and moments of Sc-44 and Sc-44m, 17: 7137 (PUC-1962-59)
HARRIS, P. S., Body Na-24 activity as measure of body dose, 17: 5775 (TID-14529)
HARRISON, G. E., Metabolism of Ca in perinatal period, 17: 5731
HARRISON, G. E., Movement of Sr in body, 17: 5712
HART, D. M., Determination of C transfer characteristics, 17: 6223
HART, R. R., Radiation effects in thermoelectrics. I., 17: 6441 (USNRDL-TR-581)
HARTECK, P., Chemical reactions initiated by fission energy, 17: 6161
HARVEY, G. G., Prog. rpt. on electronics, 6–8/62, 17: 6801 (TID-17303)
HARVEY, R. A., Analog computer applications in chemical engineering, 17: 5936 (HW-SA-2815)
HASEK, Milan, Atmospheric radioactivity in reactor environment, 17: 6290
HAUER, Gerard W., Jr., Timing operations of digital computing system, 17: 6500 (SCTM-144-62(24))
HAUGHIAN, James M., Ion source mechanism for 88-inch cyclotron, 17: 7348 (UCRL-10068)
HAUPTFUEHRER, J. Donald, X-ray barrier efficiency of building materials, 17: 6720
HAUROWITZ, Felix, Quantitation of tritiated antigens, 17: 5724
HAUSMAN, H. J., Final rpt. on imaginary part of optical potential, 1/57–9/62, 17: 7143 (TID-17357(Pt.II))
HAUSMAN, H. J., Final rpt. on total reaction cross sections, 1/57–9/62, 17: 7144 (TID-17357(Pt.III))
HAUSMAN, H. J., Final rpt. on scattering, 1/57–9/62, 17: 6957 (TID-17357(Pt.I))
HAYAKAWA, Satio, Electronic components in galactic cosmic rays, 17: 6939
HAYASHI, I., Comparison of variable-energy synchrocyclotron and sector-focused cyclotron, 17: 7379
HAYES, M. R., Determination of B in Zr metal, 17: 5970 (PG-Report-391)
HAYES, R. J., Emittance of materials, 17: 6731
HAYES, R. J., Prog. rpt. on emissivity of materials, 7–9/62, 17: 6675 (PWA-2128)
HAYTER, C. J., Measurement of γ-emitting isotopes in feces, 17: 5734
HAYWORTH, B. R., Instabilities in coaxial plasma gun, 17: 7494
HAZONI, Y., Lifetimes of M1 transitions in La-137 and Kr-83, 17: 7256
HEALY, T. V., Synergism in solvent extraction of di-, tri-, and tetravalent metal ions. V., 17: 6050 (TID-15323)
HEATH, R. L., 1.57-Mev state in Mo-94, 17: 7257
HEBEL, W., Biologic shielding against fission product γ rays, 17: 7502
HEBERLE, J., Nuclear resonance absorption of γ rays, 17: 6778 (ANL-6603(p.20-46))
HECHT, H., Gamma spectrometric studies on fallout, 17: 6346
HECKEL, Edgar, Radiation reaction of polyvinylacetate in solution, 17: 6127 (NP-12303)
HEDRICK, C. E., Separation of Fe by liquid-liquid extraction, 17: 6183 (IS-423)
HEIMBUCH, A. H., Prog. rpt. on scintillating ion exchange resin, 5/62, 17: 5940 (TID-15720)
HEIN, R. A., Critical magnetic fields of superconducting Mo, 17: 6857
HEINRICH, F., Focusing properties of spectrometer field, 17: 6414
HEINZLER, Franz, Determination of isodose of pendulum irradiation. VII., 17: 5899
HEISLER, L. H., Spread F development, 17: 6848
HELD, Barry T., Anoxic protection of small intestine by intra-arterial catheterization, 17: 5667 (BNL-5798)
HELD, S., Determination of Zn in U, 17: 6001
HELLUMS, J. D., Natural convection, 17: 6233
HEMKAR, M. P., Vibrational spectrum of Na, 17: 7132 (NP-12330(p.399-406))
HEMPELMANN, L. H., Metabolism of saccharides after whole-body x irradiation, 17: 5828
HEMPSTEAD, C. F., Currents in hard superconductors, 17: 6875
HEMPSTEAD, C. F., Magnetization and critical supercurrents, 17: 6865
HENDERSON, R. P., Monitoring of mixed neutron and γ doses, 17: 6479
HENDRIE, Joseph M., Fuel and core design of High Flux Beam Reactor, 17: 7641
HENDRIKX, Yolande, Ionic hydration, 17: 6096
HENGLEIN, A., Reaction of white P with CCl_4 under influence of radiation, 17: 6167
HENKER, H., Separation of isotopes, 17: 6492 (CEA-tr-A-1161)
HENNIG, G. R., Catalytic oxidation of graphite, 17: 6679 (TID-15270)
HENNIG, G. R., Dislocation loops in graphite, 17: 6702
HENNINGER, W. A., Neutron activation analysis of alloy steel, 17: 5984
HENRI, Victor, Inelastic charge exchange of K^+ mesons, 17: 6966
HERAS, Carlos Alberto, Scattering of neutrons by nuclei, 17: 7266
HERMSTEIN, W., Evolution of positive discharges in air up to breakdown, 17: 7575 (CEA-tr-A-1125)
HERNANDEZ, H. Paul, Superconductivity tests and studies, 17: 6807 (UCRL-9819)
HEROLD, H., Electron density and magnetic field distribution in theta pinch, 17: 7477
HERR, W., Isotopic composition of Ru in meteorites, 17: 6289
HERRERA, C. Gomez, Prospecting for U, 17: 6284
HERRINGTON, J., Determination of C in Na, 17: 5948 (AWRE-O-62/62)
HEYMANN, F. F., Quenching of ortho-positronium in He, 17: 6882
HIBBS, J. W., Effect of thyroidal I-131 release rates, 17: 5723
HIBI, Tadatosi, Experiments with electrostatic lenses, 17: 6810 (CEA-tr-X-477)

HICKMAN, B. S., Effect of neutron irradiation on BeO, 17: 6734 (AAEC/E-99)
HICKMAN, G. D., Low-energy γ rays in Xe-131, 17: 7142 (TID-15548)
HIGASHIMURA, T., Efficiency in liquid scintillation counting, 17: 6454
HILL, Ernest E., Two- and three-shift operation of pool-type reactor, 17: 7636 (UCRL-6761)
HILL, Henry A., Radioactivity of T = 0 states in V-46, Mn-50, Co-54, and Cu-58, 17: 7138 (PUC-1962-61)
HILL, R. D., Nuclear structures from K^--meson absorption, 17: 7232
HILLIARD, R. K., Fission-product confinement program, 17: 6311 (HW-SA-2843)
HILLION, Pierre, Gauge group and symmetries of isospace, 17: 6970
HILLION, Pierre, Rotator model of elementary particles in Minkowski space. I., 17: 6981
HILLION, Pierre, Space-time model of particles in Minkowski space. II., 17: 6982
HILLMANN, G., Stresses in steel plates clad with stainless steel, 17: 6586
HIMMELSTEIN, P., Prog. rpt. on fabrication of swaged fuel elements, 17: 6601 (EURAEC-372)
HINTENBERGER, H., Emission from C, Cu, and Au on bombardment by noble gas ions, 17: 7268
HINTZ, E., Construction of condenser banks with low inductivity and high energy content, 17: 6396 (JÜL-71-PP)
HIRAGA, Noburu, Absorption of H, and D, by Ti, 17: 6699 (SCL-T-451)
HIROZUMI, H., Exposure dose of radiology patients, 17: 6348
HITCHCOCK, Harley C., Superconductivity tests and studies, 17: 6807 (UCRL-9819)
HITTERMAN, R. L., Crystal structure variations in alpha U at low temperatures, 17: 6721
HOBA, D. W., Material balance information use, 17: 5665
HOCH, Michael, Thermal conductivity of graphites, 17: 6640 (ASD-TDR-62-608(Pt.I))
HODGES, H. L., Prog. rpt. on fallout, 12/31/61, 17: 6272 (ORO-520)
HODGKINS, W. R., End deformation problem of cylinders, 17: 6207 (TRG-Report-294)
HODSON, Peter Dean, Fuel element charging and discharging arrangements, 17: 7590
HOEBEL, M., Decomposition in stored carrier-free NaI^{131} solutions, 17: 5693
HOEFT, Erich, Security precaution regulations, 17: 6329
HOELLING, J., Collective description and consequences for Landau damping, 17: 7459
HOELSCHER, H. E., Kinetics of fast interfacial reactions, 17: 6584
HOENIG, A., Radiographic macrostructural testing of reinforced concrete structures, 17: 6249
HOFFMAN, Eugene Edward, Corrosion of materials by Li, 17: 6570 (ORNL-2674)
HOFFMAN, G. A., Proportions of pressure-vessel heads, 17: 6211
HOFFMAN, R. A., Protons and electrons at 12 earth radii, 17: 6922
HOFFMANN, William F., Periodic annual variations in gravitational constant, 17: 6402 (PUC-1962-56)
HOFFMEISTER, W., Isotopic composition of Ru in meteorites, 17: 6289
HOFMANN, A., Focusing properties of spectrometer field, 17: 6414
HOFMANN, F., Prog. rpt. on fabrication of swaged fuel elements, 4–6/62, 17: 6601 (EURAEC-372)
HOFMANN, P. L., Plutonium value in fast oxide breeder, 17: 7545 (HW-72304)
HOFMANN, W., Stresses in steel plates clad with stainless steel, 17: 6586
HOH, F. C., Fast gas valve for plasma research, 17: 6216
HOLBROW, C. H., Neutrons from D + T and D + H, 17: 7241
HOLLAND, Samuel S., Jr., Gamma dose rate from neutron-induced activity in earth, 17: 6258 (NDL-TR-41)
HOLLAND, W. D., Retention of tracers in dry ashing of blood, 17: 5716
HOLLIDAY, J., Extinguishing of Pu fires, 17: 6321 (TRG-Report-342)
HOLMES, John T., Diffusion in mixed solvents, 17: 6060
HOLROYD, R. A., Radiolysis of liquid hydrocarbons, 17: 6144
HOLTER, Oeivon, Finite amplitude instability of positive column, 17: 7423 (D1-82-0211)
HOLTER, Oeivin, Poynting vector in a plasma, 17: 7438
HOLTWIJK, Theodoor, Electron pair creation by photons, 17: 7304
HOLTZ, F. C., Prog. rpt. on Zr alloys, 7/1/62–9/30/62, 17: 6561 (ARF-2198-34)
HOLTZ, F. C., Prog. rpt. on coatings for V-base alloys, 9/15/62–11/12/62, 17: 6562 (ARF-B6001-1)
HONJO, Ichiiro, Incorporation of P-32 into nucleic acids of γ-irradiated tumor cells, 17: 5832
HOOD, R. R., Prog. rpt. on heavy water reactors, 9/62, 17: 7597 (DP-785)
HOOVER, M. V., R-f power sources, 17: 7338 (BNL-6511(p.306-17))
HOPKINS, E. N., Application of wax laps to vibratory polishers, 17: 6516 (IS-439)
HORAN, R. F., Determination of C transfer characteristics, 17: 6223
HORN, Elisabeth, Phase interfacial processes in Zr–N alloys, 17: 6724
HORWITZ, Norman H., Critical field of superconducting Mo, 17: 6877
HOSTETTLER, H. U., Temperature distribution by transmission time measurement, 17: 7446
HOUGHTON, L. E., Inhibition of x-ray damage to guinea pig skin, 17: 5915
HOUTERMANS, H., Definition of the curie, 17: 5660
HOVE, J. E., Space propulsion problems, 17: 6543
HOWARD, F. T., Catalogue of isochronous cyclotrons, 17: 7371
HOWARD, F. T., Conference on sector-focused cyclotrons, 17: 7352
HOWARD, K. J., Design of AERE 70-inch spiral ridge cyclotron, 17: 7374
HOWARD, V. C., Porosity in accommodation of thermal expansion in graphite, 17: 6715
HOWARD, William E., III, Microwave radiation from planet Mercury, 17: 6907
HOWE, Patrick W., Close-capture adsorption system for radioisotope chemistry, 17: 5942 (UCRL-9659)
HOWIE, A., Interstitial dislocation loops in Al, 17: 6765
HOXIE, E. C., Growth of α $Al_2O_3 \cdot H_2O$ corrosion products on Al, 17: 6573 (TID-15280)
HREN, J. A., Direct observations of heterogeneous precipitation, 17: 6687 (UCRL-10124)
HSU, James P., Transfer functions of heat exchangers, 17: 6231
HU, A. S. L., Separation of labeled from unlabeled proteins, 17: 5710
HUANG, Tieh-tsiang, Elastic scattering of protons by carbon nuclei, 17: 7081 (JINR-P-1025)
HUBER, P., Differential effective cross section of O-16, 17: 7174
HUBER, P., Improvement of coincidence method, 17: 6448
HUBER, P., Polarization capacity of O, 17: 7064
HUBER, P., Polarization capacity of Cu and Zr, 17: 7065
HUBER, P., Polarization of neutrons from (d,t) reaction, 17: 7066
HUBERMAN, M. N., Cross sections and angular distributions from Li–Li nuclear reactions, 17: 7251
HUDEC, W. S., Field imperfection effects on stability in cyclotron, 17: 7383
HUDIS, J., Product yields in Cu spallation by protons, 17: 7233
HUDSON, E. D., Concepts of an Mc^2 cyclotron, 17: 7396
HUDSON, E. D., Features in Oak Ridge isochronous cyclotron, 17: 7357
HUDSON, E. D., Measurement of ORIC magnetic field, 17: 7375
HUEDA, A. Uriarte, Ion exchange of natural leaching solutions, 17: 6193
HUETTER, T., Evidence for $K^+ \rightarrow \pi^+ + \pi^- + e + \nu$ decay mode, 17: 6999
HUGHES, E. E. Glenda, Etching of graphite surfaces, 17: 6722
HUGHES, H., Model of continent formation, 17: 6291
HUGHES, John P., Determination of Rh, 17: 5985
HUGHES, V. W., Design study of linear accelerators, 17: 7316 (BNL-6511 (p.98-100))
HUGHES, Vernon W., Magnetic moments of μ-mesonic atoms, 17: 7213
HULL, G. W., Jr., Superconductivity of solid solutions of noble metals, 17: 6860
HULTBERG, S., Gamma intensity in decay of Ir-192, 17: 7151
HUNGATE, F. P., Antibiotic resistance and radiation induced mutation in *C. columnaris*, 17: 5769 (HW-SA-2540)
HUNT, R. A., Anticoincidence counter for tropical conditions, 17: 6456
HUNTER, Neville John, Radiation-resistant lubricants, 17: 6770
HUNTLEY, G. H., Radiosensitivity of DNA synthesis in mouse spleen, 17: 5830
HUNZINGER, W., Differential effective cross section of O-16, 17: 7174
HURLEY, James, Transition region between uniform plasma and magnetic field. II., 17: 7461
HURLEY, P. M., Model of continent formation, 17: 6291
HURLICH, Abraham, Materials for cryogenic temperature applications,

17: 6542
HYDE, C., Sinterable MgO powders and ceramics, 17: 6590 (ASD-TDR-62-700)

I

IAL, Manohar, Nuclear recoil following radiative capture of neutrons by Co-59, 17: 7133 (NP-12330(p.407-14))
IGENBERGS, P., Electron density and magnetic field distribution in theta pinch, 17: 7477
IGNATENKO, A. E., Decay of mesic atoms of transition metals, 17: 6888
IGO, George, Elastic scattering of 31-Mev He^3 ions, 17: 7148 (UCRL-9996)
IHLE, H., Spectrophotometric studies of uranyl ion system, 17: 5955 (JUL-74-PC)
IKLE, F. A., Urologic complications in treatment of cervical carcinoma, 17: 5815
ILLING, Derek, Radiation-resistant lubricants, 17: 6770
ILYASOVA, N. V., Determination of rare earths in rocks, 17: 6008
ILYIN, V. V., Lifetimes of excited states Dy-160, Lu-175, Hf-177, and Ir-191, 17: 7292
IL'YUSHIN, A. A., Strength of shells exposed to irradiation, 17: 6754 (FTD-TT-62-719)
INGRAM, David John, Fluid-cooled reactors, 17: 7591
INGRAM, M., Treatment of meats with radiations. X., 17: 6367
INNES, J. G., Analyzing methods for ORIC magnetic fields, 17: 7385
INOMATA, Akira, Mass gauge invariance, 17: 7015
INOPIN, E. V., Inelastic diffraction scattering, 17: 7205
INOUYE, H., High-thermal-conductivity fin material for radiators, 17: 6673 (ORNL-2065)
IOFFE, B. L., Hypotheses regarding nature of resonances, 17: 7048
IRISH, E. R., Fission-product confinement program, 17: 6311 (HW-SA-2843)
IRISH, E. R., Prog. rpt. on fixation of radioactive residues, 7–9/62, 17: 7652 (HW-75290)
ISAEV, P. S., Effect of $\pi\pi$ interaction on πN scattering, 17: 7024
ISAKOFF, L., Prog. rpt. on heavy water reactors, 9/62, 17: 7597 (DP-785)
ISBELL, H. S., Recrystallization of D-mannose-1-t phenylhydrazone, 17: 6118
ISHIBE, Yukio, Hot plasma produced by linear discharge device, 17: 7449
ISHIDA, Morihiro, Statistical aspects of tumor registries, 17: 6333
ISHISAKI, Yoshihide, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
ISRAEL, S., Prog. rpt. on two-phase flow patterns with heat addition, 7–9/62, 17: 7613 (UNC-5042)
ISSERLIS, George, Joining of rarer metals, 17: 6627
ITAHARA, K., Electrolyte concentrations of intra- and extracellular compartments in internal diseases, 17: 5694
ITO, K., Electrolyte concentrations of intra- and extracellular compartments in internal diseases, 17: 5694
IVANOV, V. A., Gamma and internal conversion spectra in Gd isotopes, 17: 7175
IVANOV, Yu. A., Reaction of various types of wheat and barley to irradiation, 17: 5903
IVEY, H. J., Saturation pool boiling burnout at atmospheric pressure, 17: 6241
IYENGAR, K. N., Emission of α particles in fission process, 17: 7097 (NP-12330(p.71-8))
IYENGAR, S. B. D., Multiplication constants of BeO–U lattices, 17: 7131 (NP-12330(p.392-8))
IYER, S. A., Quadrupole coupling constants of Na-23 and B-11, 17: 7127 17: 7127 (NP-12330(p.295-301))
IZEKI, A., Exposure dose of radiology patients, 17: 6348

J

JABBUR, R. J., Spectrum of electron and positron bremsstrahlung, 17: 6983
JACCARINO, V., Ultra-high-field superconductivity, 17: 6873
JACKSON, C. N., Jr., Fuel element contamination tester, 17: 6434 (HW-73155)
JACKSON, D. D., Vaporization of Gd and Th dicarbides, 17: 6109
JACKSON, H. E., Gamma spectra from capture in neutron resonances, 17: 6776 (ANL-6603(p.1-8))
JACOB, P., Experimental radiobiology of tumors, 17: 5812
JACOBS, Lewis G., Cancer therapy supervoltage x-ray (review), 17: 5682
JACQUEMIN, J., Critical masses for core arrangements in FRJ-1 Merlin, 17: 7559 (JÜL-76-RE)
JACQUET, J., Experimental radiobiology of tumors, 17: 5812
JAEGER, R. G., Definition of the curie, 17: 5660
JAEGER, Th., Containment vessels for power reactors, 17: 7620
JAHR, R., Reactions $F^{19}(\alpha,t)Ne^{20}$ and $F^{19}(He^3,d)Ne^{20}$, 17: 7224
JAIN, R. D., Energy distribution of thermal neutrons in Be, 17: 7129 (NP-12330(p.378-83))
JAMES, D. B., Anion-exchange separation of Pu and Th, 17: 6187 (TID-14598)
JAMES, John Aylward, Containers for use in reactors, 17: 7592
JAMES, Williams, Magnetic structure of alloys YCo_5 and $HoCo_5$, 17: 6706
JAMESON, A. S., BONUS reactor pressure vessel, 17: 7600 (GNEC-210-(Suppl. 1))
JAMMES, R., Yttrium-90 needles in interstitial β therapy, 17: 5695
JAN, J. P., Structural hardening of Cu–Be alloys, 17: 6710
JANCEL, R., Electron distribution function in discharge. I., 17: 7451
JANSEN, C. R., Widening Bragg peak in path of charged heavy particles in tissue, 17: 5766 (BNL-5538)
JARMIE, Nelson, Reactions $He^3 + t$, 17: 7250
JEFFERYS, R. A., Protective coatings for Nb alloys, 17: 6510 (ASD-TDR-62-934)
JEMISON, William F., Sterilization—improvement through monitoring, 17: 6407 (TID-15453)
JENSEN, A., Rotating rig for dosimeter calibration, 17: 6475
JENSEN, Kenneth J., Rubidium determination in NaI(Tl) crystal, 17: 5989
JHINGAN, M. L., Bismuth(γ,p) reaction, 17: 7092 (NP-12330(p.35-8))
JIMBO, T., Electrolyte concentrations of intra- and extracellular compartments in internal diseases, 17: 5694
JIMERSON, G., Tools for broaching Rene 41, 17: 6623
JNANANANDA, Swami, Carbon-12 excited states, 17: 7102 (NP-12330 (p.104-8))
JNANANANDA, Swami, Pair cross section of γ radiation, 17: 7116 (NP-12330(p.186-92))
JOHN, R. R., Power plant consideration for arc-jet propulsion system, 17: 7649
JOHNS, H. E., Whole-body scanning in medicine. I., 17: 5684
JOHNSEN, K., Debunchers, 17: 7332 (BNL-6511(p.267-73))
JOHNSON, A. A., Post startup reactor safety, 17: 7628 (TID-15677)
JOHNSON, O. E., Positron decay of Y-88, 17: 7254
JOHNSON, R. A., Containment for boiling water reactors, 17: 7626
JOHNSON, V. J., Ferroelectric solid solutions possessing relatively large spontaneous polarizations, 17: 6678 (TID-14508)
JONCKHEERE, Robert E. L., High stability electrostatic generator, 17: 6384 (CEA-2143)
JONES, A. R., Gamma dosimeter with long memory, 17: 6460
JONES, E. S. O., Ionospheric effects of nuclear explosions, 17: 6847
JONES, I. R., Radioiodine in milk of cows, 17: 6356
JONES, Jack, Reactor refueling machines, 17: 7589
JONES, P. R., Resonant electron capture and stripping in Ne^+–Ne collisions, 17: 6863
JONES, R. J., Beam-measurement studies, 17: 7410
JONES, R. J., Concepts of an Mc² cyclotron, 17: 7396
JONES, R. J., Features in Oak Ridge isochronous cyclotron, 17: 7357
JONES, R. J., Remarks on tune-up of Analogue II, 17: 7400
JONES, W. B., Spill beam from 88-inch cyclotron, 17: 7356
JORDAN, Dean L., Acquired radioresistance, 17: 5776 (TID-14698)
JORDAN, Dean L., Rate of recovery from radiation injury, 17: 5909 (TID-14019)
JORDAN, P. L., Prog. rpt. on stress-corrosion cracking of high-strength alloys, 17: 6569(R) (NP-12369)
JORDAN, W. C., Particle behavior in magnetic mirror geometry, 17: 7465
JORDAN, Willard C., Particle behavior in magnetic mirror and cusp geometries, 17: 7466
JOSEPH, C., Efficiency of detector shielding, 17: 7067
JOSEPH, C., Light yield of solution NE 213 to protons, 17: 6119
JOSHI, B. V., Multiplication constants of BeO–U lattices, 17: 7131 (NP-12330(p.392-8))
JOSHI, M. C., Decay of Eu-156, 17: 7108 (NP-12330(p.141-6))

JOSHI, S. K., Vibrational spectrum of Na, 17: 7132 (NP-12330(p.399-406))
JUDD, D. L., Dissociation of H ions in cyclotrons, 17: 7360
JUDD, D. L., Electrostatic deflector for Berkeley cyclotron, 17: 7404
JUDGE, Darrell L., Hydromagnetic waves in geomagnetic field, 17: 6926
JUNGERMAN, J. A., Spiral ridge cyclotron at Univ. of California, Davis, 17: 7370
JUNG-KOENIG, Wilhelm, Corrosion-resistant Zr alloys, 17: 6581
JURA, George, Calibration of Bridgman anvils, 17: 6410 (UCRL-9807)
JURAIN, Georges, Geochemistry of U–Ra and Th families in Southern Vosges, 17: 6252 (CEA-2154)
JUSTI, E., Thermoelectric power of thin metallic films, 17: 6700 (UCRL-Trans-892(L))
JUUL, N., Prog. rpt. on properties of carbons and graphites, 8–9/62, 17: 6670 (NP-12350)

K

KACSER, C., Single-loop four-point diagrams in $K \to 3\pi$ decay, 17: 6944 (BNL-5528)
KADLEZ, K., Development in nuclear technology, 17: 7578
KADOMISEV, B. B., Anomalous diffusion of rarefied plasma, 17: 7487
KAESER, O., Urologic complications in treatment of cervical carcinoma, 17: 5815
KAGAN, Yu., Law of dispersion of phonons, 17: 6892
KAHAN, T., Electron distribution function in discharge. I., 17: 7451
KAHN, B., Radioiodine in milk of cows, 17: 6356
KAHN, Edgar A., Mercury-203 labeled neohydrin, 17: 5841
KAIPOV, D. K., Lifetime of the level 4^+ (1282 kev) of Cd-114, 17: 7283
KAKEI, H., Method of thyroid I-131 uptake, 17: 5743
KAKINUMA, T., Microwave solar radiation, 17: 6906
KALINCHENKO, L. P., Titrimetric determination of Be, 17: 6011
KALINICHENKO, I. I., Titrimetric determination of Be, 17: 6011
KALINKIN, L. F., Gamma-γ coincidences in $Ag^{107}(n,\gamma)Ag^{108}$, 17: 7285
KALLAI, L., Effect of casein on incorporation of Sr, 17: 5745
KALNS, E., Arc-cast Mo- and W-base alloys, 17: 6672 (NP-12383)
KALOGEROPOULOS, T. E., Isobar pairs in $\bar{p}$-p collisions, 17: 7002
KAMAL, T. H., Ultrafiltrable Ca-45 and P-32 in milk synthesis, 17: 5722
KAMEGAI, M., Cross sections and angular distributions from Li–Li nuclear reactions, 17: 7251
KAMENSKII, S. G., Optical potential and Green's function, 17: 7187
KANGILASKI, Mihkel, Fission-product-release measurement from clad fuel, 17: 6645 (BMI-1604)
KANTELE, J., Isotope In-122, 17: 7216
KANTOR, Frederick W., Image force velocity selector for charged particles, 17: 6466
KAPHAYKHOV, V. A., Determining proton emission by nuclei, 17: 7082 (JINR-P-1072)
KAPLAN, Coleman, Materials for thermionic converters, 17: 6553
KAPLAN, Jerome I., Perturbation theory using reduced set of states, 17: 7509
KAPLAN, Selig N., Electron detachment from neutral H, 17: 6880
KAPOOR, S. S., Angular correlations of fission fragments in U-235, 17: 7098 (NP-12330(p.79-85))
KAPOOR, S. S., Emission of α particles in fission process, 17: 7097 (NP-12330(p.71-8))
KARALOVA, Z. K., Determination of B in BeO, 17: 6015
KARBAN, O., Polarization of protons scattered on C, 17: 7166
KARIBSKAYA, E. V., Peripheral blood action of radiation, 17: 5850
KARMAS, Endel, Freeze-dehydrated irradiated pork, 17: 6365
KARPLUS, Robert, Attenuation of hydromagnetic waves in ionosphere, 17: 6913
KARRAS, M., Isotope In-122, 17: 7216
KARTASHEV, K. B., Effect of magnetic field on toroidal electric discharge, 17: 7445
KASHCHENKO, L. A., Effect of radiation on gonad stimulation of ovary, 17: 5817
KATANA, P. K., Theory of multi-phonon transitions, 17: 6887
KATAYAMA, Mikio, ESR of γ-irradiated crystal of acetyl-L-glutamic acid, 17: 6152
KATAYAMA, Yoshiso, Mass levels of particles and resonance states, 17: 7012
KATO, Masaaki, Photopion production and $(\gamma,3\pi)$ interaction. II., 17: 7007
KATS, G. I., Oxidative metabolism in *Staphylococcus aureus*, 17: 5790
KATSURA, Y., Bone marrow of A-bomb survivors, 17: 5785
KATZ, Amnon, Goldstone expansion corrections, 17: 6497 (NP-12304)
KAUFMAN, Allan N., Microscopic basis of macroscopic magnetostatic energy, 17: 6834
KAUFMANN, Otto K., European convention on civil liabilities, 17: 6328
KAUMP, D. H., Final rpt. on radiobiology, 11/62, 17: 5910 (TID-17379)
KAWAGUCHI, Masaaki, Photopion production and $(\gamma,3\pi)$ interaction. II., 17: 7007
KAWAKAMI, M., Reverse isotope effect of C-14 in Beckmann rearrangement, 17: 6065
KAWASAKI, Masayuki, Corrosion of Al in high-pressure steam, 17: 6580
KAWATRA, M. P., Quantum mechanics of many-body system, 17: 7511
KAYE, S., Prog. rpt. on radiation-resistant solar cell, 7/1-10/31/62, 17: 6795 (NP-12317)
KAYSER, F., Biosynthesis of carotenoids, 17: 5809
KAZARINOV, N. M., Angular anisotropy of γ quanta accompanying U-235 fission, 17: 7293
KAZARINOV, Yu. M., Phase-shift analysis of nucleon-nucleon scattering, 17: 7027
KEBARLE, P., Dissociation of deuterated ethyl and isopropyl acetates, 17: 6164
KEDEM, Dror, Gyromagnetic ratio of 2^+ state of Os-188, 17: 7225
KEGLEY, T. M., Jr., Corrosion of Ni-base specimens exposed in volatility plant, 17: 6571 (ORNL-TM-411)
KEIL, Horst, Rate of evaporation of Ta in vacuum, 17: 6726
KEIL, K. D., Recrystallization of D-mannose-l-t phenylhydrazone, 17: 6118
KEILHACKER, M., Energy yield of electrons and x rays in theta pinch, 17: 7478
KEISCH, Bernard, Yield ratios of isomers produced by neutron activation, 17: 7248
KEITH, George H., Physical metallurgy of W, 17: 6688 (WADD-TR-60-37(Pt.III))
KELBER, Charles N., Research reactors, 17: 7635 (TID-15608)
KELLER, Hans Ludwig, Uniform irradiation by rotating pendulum for moving field irradiation, 17: 6358
KELLEY, W. D., Determination of U^{236} in impure U materials, 17: 5979 (TID-15359)
KELLMAN, S., Elastic scattering of π^- by protons at 152 and 226 Mev, 17: 6977
KELLY, E. L., Characteristics of Berkeley cyclotron, 17: 7355
KELLY, J. W., Performance of Schultz-type goniometer, 17: 6380 (AAEC/TM-158)
KELLY, Raymond L., Diagnostic measurements on P-4 steady-state plasma, 17: 7432 (UCRL-6562)
KELSEY, C. A., Polarization and angular distributions from $Be^9(p,\alpha)B^8$, 17: 7246
KEMP, L. A. W., Ionization chamber as current reference standard, 17: 6461
KEMP, Robert F., Beam neutralization tests of flight model electron bombardment engine, 17: 7646
KENAWY, M., Hydrogen isotope exchange with aqueous suspensions of catalysts, 17: 6098
KEPPLER, E., Geomagnetic storm sudden commencement, 17: 6928
KERLEY, Peter, Cause of death of x-ray martyrs, 17: 5804
KERN, J., Decay of Ir-192, 17: 7172
KERR, Eugene C., Expansion coefficient of liquid He-3, 17: 6819
KERR, M. E., Reproductive performance of swine ingesting Sr-90, 17: 5700 (HW-74969)
KERR, R. E., Extending reactor time-to-poison, 17: 7536 (CRIO-1115)
KERSWELL, A. G., X radiography of radioactive specimens using rotating Pb disk, 17: 6419
KERTAI, P., Regeneration of liver of x-irradiated rats, 17: 5854
KESSELMAN, P. M., Thermodynamic similarities between D_2O and H_2O, 17: 6059 (CEA-tr-R-1541)
KESSLER, Woodrow B., Irradiation and 3-methylcholanthrene administration in breast tumor, 17: 5839
KEVER, H., Controlled thermonuclear experiments, 17: 7453
KEYFITZ, I. M., Superheat power experiments in development of nuclear power plants, 17: 7624
KHABIBULLIN, B. M., Neutron scattering in paramagnetic materials, 17: 7072

KHABIBULLIN, B. M., Slow neutron scattering by spin system of paramagnetic material, 17: 7073
KHALKIN, V. A., Reactions (p,xn) and (p,2xn) type on Te isotopes, 17: 7297
KHITROV, V. G., Determination of rare earths in rocks, 17: 6008
KHOE, Tat K., Duty factor of isochronous cyclotron, 17: 7411
KHOMIKOVISKII, P. M., Radiation effect on combined acrylonitrile and ethylene polimerization, 17: 6166
KHRIPLOVICH, I. B., Mass of complex vector field, 17: 7519
KHVOSHCHEV, A. N., Magnetic constriction of electron-hole plasma, 17: 7479
KHVOSTOVA, V. V., Tomato mutants induced by γ radiation, 17: 5892
KIDD, D. E., Operation of 40-inch cyclotron, 17: 7354
KIKUCHI, Ken, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
KIM, Chong Kuk, Radioisotope production, processing, distribution, and applications in Korea, 17: 6371
KIM, Y. B., Currents in hard superconductors, 17: 6875
KIM, Y. B., Magnetization and critical supercurrents, 17: 6865
KIM, Young S., Spin rotation coefficients in π-N scattering, 17: 6985
KIMBREL, Laddie G., Kill probability in target area family shelters, 17: 6345
KIMURA, Tosaku, Molecular weight distribution of irradiated polymers, 17: 6764
KING, A. I., Double collimator isotope detection of carotid blood flow, 17: 5732
KIRK, Albert Walter, Improvements relating to standard leaks, 17: 6427
KIRSHENBAUM, A. D., Temperature range of liquid Pb and Ag, 17: 6711
KIRZHNITS, D. A., Statistical nuclear model, 17: 7284
KISELEV, M. I., Magnetogasdynamic generator theory, 17: 6812 (FTD-TT-62-1181)
KISTEMAKER, J., Excitation processes in He, 17: 7263
KITAGAKI, Toshio, e-μ Transitions induced by electromagnetic interactions, 17: 7009
KITTREDGE, C. P., Detection and location of cavitation, 17: 6401 (MATT-142)
KJELLSBY, E., Measurement of neutron densities, 17: 6474
KLEIN, G. W., Radiolysis of liquid hydrocarbons, 17: 6144
KLEIN, J. G., Helical finned tube development, 17: 6599 (TID-17340)
KLEINECKE, D. C., Comparison between Anderson's "dynamic" model of fallout and other models, 17: 6307 (CDRP-182-112)
KLEINECKE, D. C., Estimating fallout by regression methods, 17: 6306 (CDRP-182-105)
KLEINECKE, D. C., Fallout shelter survey, 17: 6302 (AD-276119)
KLEMA, E. D., Thermal neutron flux perturbation in diffusing media, 17: 6484
KLEMPERER, William, Molecular constants of Li hydride, 17: 6077
KLEPIKOV, N. P., Threshold singularities in total cross sections, 17: 7033
KLESCHICK, A., Lipid composition of liver mitochondria from normal and irradiated rats, 17: 5772 (TID-13322)
KLESSMANN, H., Radiation monitor with transistors, 17: 6457
KLIGERMAN, Morton M., Anoxic protection of small intestine by intra-arterial catheterization, 17: 5667 (BNL-5798)
KLINE, M.-C., Conway granite of New Hampshire, 17: 6297
KLINKENBERG, Adriaan, Transient heat transfer in packed beds, 17: 6234
KLOZENBERG, J. P., Energy equipartition in EM wave, 17: 7472
KLUCHAREV, A. P., Decay of millisecond isomers, 17: 7294
KLYUCHAREV, A. P., Reactions of total decay of nuclei, 17: 7282
KNAAP, Henricus Franciscus Petrus, Hydrogen isotopes, 17: 6103
KNEPPEL, D. S., Prog. rpt. on Be corrosion, 7/72–9/62, 17: 6568 (NMI-1905)
KNIZHNIKOV, V. A., Effect of Sr and F on hemopoiesis in rats, 17: 5822
KNOGLINGER, E., Thermal load limits for graphite fuel balls, 17: 7576
KNOLLMAN, G. C., Quantum cell model for bosons, 17: 6993
KNOWLES, H. B., Conference on linear accelerators, 8/62, 17: 7308 (BNL-6511)
KNOWLES, H. B., Shielding and experimental layout, 17: 7318 (BNL-6511 (p.110-23))
KNOWLES, H. B., Stepped phase velocity linac, 17: 7328 (BNL-6511 (p.209-23))
KNOX, Robert S., Valence band structure of AgCl, 17: 6053 (TID-17447)
KOBBERT, E., Radiation effects on oxidative phosphorylation in mitochondria, 17: 5784
KOBZAREV, I. Yu., Gravitational interaction of fermions, 17: 7049
KOBZAREV, I. Yu., Possible decays of new mesons, 17: 7022
KOCH, Arthur L., Evaluation of rates of biological processes. I., 17: 5726
KOEHLER, D. R., Isomeric transition in Sm-143, 17: 7237
KOEHLER, H. S., Reaction matrix theory for finite nucleus, 17: 7211
KOEHLER, J. S., Neutron damage in Ge, 17: 6757
KOEHLER, W., West-European laboratories for radioactive materials, 17: 6157
KOELLING, R. A., Detection of x rays by the rat, 17: 5857
KOEPPE, P., Automatic scanner for nuclear emulsions, 17: 6476
KOERNER, H. J., Rotation levels of Er-168, 17: 7270
KOHLER, M., Thermoelectric power of thin metallic films, 17: 6700 (UCRL-Trans-892(L))
KOLAR, Jaromir, Calcium exchange in the epi- and metaphysis after local x irradiation. IV., 17: 5901
KOLKUNOV, V. A., Invariant phase volume of N particles, 17: 7030
KOLLER, E. L., Evidence for $K^+ \to \pi^+ + \pi^- + e + \nu$ decay mode, 17: 6999
KOLLMANN, George, Distribution and metabolism of MEG and GED, 17: 5908 (SAM-TDR-62-68)
KOLPAKOV, V. A., Blood and bone marrow picture in irradiation, 17: 5852
KOLTUN, D. S., Nuclear many-body problem with nonuniform density. I., 17: 7260
KOMAR, A. P., Deuteron emission in photodisintegration of O-16, 17: 7295
KOMAR, A. P., Energy distributions of U-238 photofission fragments, 17: 7291
KOMAREK, K. L., Properties of Zr–O, Ti–O, and Hf–O systems, 17: 6111
KONDAIAH, E., Bismuth(γ,p) reaction, 17: 7092 (NP-12330(p.35-8))
KONDAIAH, E., Direct interactions in low-energy nuclear reactions, 17: 7091 (NP-12330(p.22-34))
KONDAIAH, E., Life time of first excited state of Sn-116, 17: 7110 (NP-12330(p.152-7))
KONDO, Tatsuo, Corrosion of Al in high-pressure steam, 17: 6580
KONDRAT'EVA (KONDRAT'YEVA), M. A., Antimatter in cosmic rays and outer space, 17: 6915
KONDUROV, I. A., Production of short-lived isotopes in VVR-M reactor, 17: 6170
KONISHI, Atsuo, Absorption of H, and D, by Ti, 17: 6699 (SCL-T-451)
KONOPASEK, F., University of Manitoba cyclotron, 17: 7368
KOO, Ronald C., Physical metallurgy of W, 17: 6688 (WADD-TR-60-37 (Pt.III))
KOOP, W. H., Predisposal treatment of NPR decontamination wastes, 17: 7651 (HW-74507)
KOPANETS, E. G., Decay scheme of K-41, 17: 7177
KOPP, P. M., Sulfur as protecting agent against radiations, 17: 5923
KOPVILLEM, U. Kh., Absolute polarization of magnetic nuclei, 17: 7267
KOPYLOV, V. A., Quinones in initial stages of radiation damage to animal tissue, 17: 5880
KORCHANOV, L. S., Therapy of acute radiation sickness, 17: 5925
KORCHEMNAYA, E. K., Chemistry of Th, 17: 6021
KORDA, Yu. S., Decay of millisecond isomers, 17: 7294
KOROLEV, F. A., Polarization properties of synchrotron radiation, 17: 7418
KOROL'KOV, I. Ya., Internal conversion pairs in thermal neutron capture in Gd, 17: 7182
KOROTKOVA, V. P., Recording of injuries in nervous system from irradiation, 17: 5886
KORTELING, Ralph Gerret, High-energy reactions of Nb with protons and He ions, 17: 7149 (UCRL-10461)
KOSKI, W. S., Boron hydrides in radiation-induced reactions in penta- and decaborane, 17: 6147
KOSMIDER, Stanislaw, Experimental radiation disease in rabbits, 17: 5912
KOSS, P., Coated fuel particles, 17: 7577
KOSTYK, I., Lipid composition of liver mitochondria from normal and irradiated rats, 17: 5772 (TID-13322)
KOTAJIMA, Kyuya, E4 cross-over transition in isomeric decay of Pb-204, 17: 7196
KOTAS, J., Rabbit kidney after x irradiation, 17: 5904
KOTELCHUCK, D., Elastic μ^- scattering in nuclear emulsion, 17: 6988

KOTHARE, V. V., Corrosion and deposition on fuel rod cladding, 17: 6587
KOTLYAREVSKII, I. L., Obtaining a polymer based on p-diethynylbenzene, 17: 6117 (SCL-T-446)
KOTOV, Yu. D., Origin of cosmic muons and photons of high energy, 17: 6940
KOVACIK, W. P., Elastic scattering of π^- by protons at 152 and 226 Mev, 17: 6977
KOVASZNAY, Leslie S. G., Plasma turbulence, 17: 7492
KRAMER, H. A., Telemetering installation to report Columbia River data by radio, 17: 6394 (HW-SA-2481)
KRAMER, Harry A., Lake storage lowering of river temperatures, 17: 6255 (HW-SA-2301)
KRAMER, Henry, Formation of hydrazine from radiolysis of ammonia, 17: 6125 (BNL-6016)
KRAMER, P., Decays of the ω and η mesons, 17: 6998
KRAMER, P., Pion resonances in π^+-p interactions, 17: 6997
KRASILNIKOV, V. A., Ultrasonic splitting of Mössbauer line in $Sn^{119}O_2$, 17: 6889
KRAUSE, A. J., Prog. rpt. on solar thermoelectric generator, 2–5/62, 17: 7642 (AD-276092)
KRAUSHAAR, J. J., University of Colorado 52-inch cyclotron, 17: 7358
KRAYBILL, H. F., Civil defense in the food industry. III., 17: 6340
KREJCI, V., Striations in h-f discharge, 17: 7444
KREN, Emil, Orientation of large single crystals, 17: 6058 (AEC-tr-5566)
KRESGE, A. J., Proton transfer in aqueous solution, 17: 6121
KRESTNIKOV, Yu. S., Generation of π^0 mesons in Coulomb field of nucleus, 17: 7020
KRESTNIKOV, Yu. S., Resonance in $K^0\bar{K}^0$ pair production, 17: 7039
KREVINSKAYA, M. E., Formation of plutonyl complexes in HNO_3, 17: 6191 (CEA-tr-R-1514)
KREY, Philip W., Prog. rpt. on high-altitude sampling program, 12/1/62, 17: 6271 (NYO-10464)
KRIEGEL, Heinz, Influence on embryonal development of x irradiation, 17: 5897
KRIKORIAN, O. H., Vaporization of Gd and Th dicarbides, 17: 6109
KRIMMELL, J. C., Vector-following centrifuge fixtures, 17: 6206 (SCTM-219-62(73))
KROELL, W., Lowering ionization energy for plasma, 17: 7458
KROLL, H., Prog. rpt. on fabrication of swaged fuel elements, 4/6/62, 17: 6601 (EURAEC-372)
KRONGAUZ, A. N., Dosimeter for x- and γ radiation, 17: 6471
KROUSER, H., Decay of Eu-152, 17: 7203
KRUGER, O. L., Preparation and properties of arc-cast PuC, 17: 6637 (ANL-FGF-321)
KRUGER, Owen L., Phase studies of Pu–C alloys, 17: 6638 (ANL-FGF-343)
KRYLOVETSKII, A. G., Pair correlations in nuclei, 17: 7190
KUBO, Hiroshi, Microwave emission of cold plasma, 17: 7435 (AEC-tr-5564)
KUCHIN, I. A., Inelastic nucleon-nucleon interactions, 17: 7040
KUDERA, D. E., Determination of Fe in U–fission element alloys, 17: 5.78 (TID-15319)
KUDRIN, L. P., Equation of state of plasma, 17: 7484
KUEPPER, F. P., Electron density and magnetic field distribution in theta pinch, 17: 7477
KUGLER, Moshe, Nuclear vibrations, rotations, and the shell model. II., 17: 7221
KUHN, B., Reaction $C^{13}(t,p)C^{14}$, 17: 7296
KULAKOV, V. M., Fine structure of the Pu-239 α radiation, 17: 7277
KULIK, I. O., Heat anomaly of superconductors, 17: 6893
KULIKOV, A. V., Deuteron emission in photodisintegration of O-16, 17: 7295
KULIKOV, B. N., Reaction of various types of wheat and barley to irradiation, 17: 5903
KULIKOV, O. F., Polarization properties of synchrotron radiation, 17: 7418
KUMAR, C. K., Alpha spectra using solid state detectors, 17: 7119 (NP-12330(p.202-8))
KUMEKIN, Yu. P., Amplitudes of nucleon-nucleon scattering, 17: 7080 (JINR-P-1024)
KUMEKIN, Yu. P., Elastic scattering of protons by carbon nuclei, 17: 7081 (JINR-P-1025)
KUMEKIN, Yu. P., Triple scattering of 660-Mev protons. III., 17: 7041
KUNICK, I., Therapeutic effect of chemicals in x irradiation, 17: 5859
KUNKEL, Wulf B., Hydromagnetic ionizing fronts, 17: 7433 (UCRL-9971)
KUNTSEL, I. A., Relative intensities of NQR lines of Sb-121, 17: 7299
KUPRIUANOV, S. E., Dissociation of D_3^+ ions in collisions with D_2 molecules, 17: 6896
KUPTSOV, A. V., Decay of mesic atoms of transition metals, 17: 6888
KURATH, Dieter, Intermediate coupling, 17: 7140 (TID-14921)
KURNOSOVA, L. V., Charged particle intensity during space-ship flights, 17: 6935
KURODA, P. K., Prog. rpt. on fallout, 12/31/61, 17: 6272 (ORO-520)
KUROHARA, S. S., Creatine concentration in erythrocytes, 17: 5856
KUSS, Bertram, Radiation effects on glucose and fatty acid transport in small intestine, 17: 5933
KUSSY, Maxine E., Photometric determination of B, 17: 5998
KUZIN, A. M., Quinones in initial stages of radiation damage to animal tissue, 17: 5880
KUZMA, Joseph F., Concentration of Sr at bone tumors, 17: 5729
KUZNETSOV, E. V., Generation of π^0 mesons in Coulomb field of nucleus, 17: 7020
KUZNETSOV, E. V., Resonance in $K^0\bar{K}^0$ pair production, 17: 7039
KUZNETSOVA, M. Yu., Reactions (p,xn) and (p,2xn) type on Te isotopes, 17: 7297
KUZNETSOVA, T. D., Thermal conductivity of H plasma, 17: 7439
KUZNETSOVA, T. I., Theory of quantum generators, 17: 7523
KWAN, T., Separation of H isotopes, 17: 6493
KYRS, Miroslav, Mechanism of extracting Cs compounds, 17: 6194

L

LACOMBE, Paul, Plastic deformation and rupture of U, 17: 6707
LACY, D., Hormone synthesis by sertoli cells, 17: 5842
LADU, M., Lethal γ dose for *Mus musculus*, 17: 5863
LAGOMARSINO, Raymond J., Prog. rpt. on high-altitude sampling program, 12/1/62, 17: 6271 (NYO-10464)
LAGUN, M. A., Effect of thyreoidine after acute radiation sickness, 17: 5885
LAJTHA, L. G., Extracorporeal irradiation of the blood, 17: 5847
LAJTHA, L. G., Radiosensitivity of DNA synthesis in mouse spleen, 17: 5830
LAKATOS, Bela, Comparison of chemistry of cis- and trans-uranides with La and transition metals, 17: 6091
LAKSHIMINARAYANA, V., Pair cross section of γ radiation, 17: 7116 (NP-12330(p.186-92))
LAL, B., Bismuth(γ,p) reaction, 17: 7092 (NP-12330(p.35-8))
LALANNE, C. M., Total-body irradiation for organ transplantation, 17: 5874
LALLEMAND, Pierre, Damage caused by proton irradiation, 17: 6759
LAMBERT, J. M., University of Michigan 83-inch cyclotron. IV., 17: 7367
LAMBORN, B. N. A., Collective motion in beam-plasma system, 17: 7429 (TID-17336)
LAMPE, Isadore, Radiation treatment of pituitary adenomas, 17: 5840
LAMPHERE, R. W., Fast neutron-induced fission of U-234, 17: 7204
LAND, C. C., Thermal expansion of PuC and PuC–UC, 17: 6662 (LA-2768)
LANDSMAN, D. A., Inert diluents for use in nuclear extraction plants. I., 17: 6195
LANE, E. S., Inert diluents for use in nuclear extraction plants. I., 17: 6195
LANE, Joseph R., Refractory metals sheet rolling, 17: 6517 (MAB-188-M)
LANE, R. O., Neutron polarization and differential cross sections, 17: 6777 (ANL-6603(p.9-19))
LANE, W. B., Zinc bromide shielding window, 17: 7498 (USNRDL-TR-594)
LANGENDORFF, H., Therapeutic effect of chemicals in x irradiation, 17: 5859
LANGENDORFF, Hanns, Influence on embryonal development of x irradiation, 17: 5897
LANGER, G., Prog. rpt. on airborne particles, 10/1–12/1/62, 17: 6304 (ARF-3187-10)
LANGER, Rudolph E., Symposium on electromagnetic waves, Madison, Wis., 4/61, 17: 7052
LANGSDORF, A., Jr., Neutron polarization and differential cross

sections, 17: 6777 (ANL-6603(p.9-19))
LANIUS, K., Description of cosmic-ray jet, 17: 6919
LAPIDES, M. E., Preliminary design notes for fuel elements, 17: 7537 (DC-61-4-37)
LAPIDUS, L. I., Scattering of γ quanta and polarizability of nuclei and nucleons, 17: 7025
LAPOSTOLLE, P., Isochronous cyclotron meson factory, 17: 7395
LARANJA, Almir Augusto, Production of U(IV), 17: 6177 (IEA-47)
LARSEN, W. L., Thorium–Mo phase diagram, 17: 6659 (IS-442)
LARSON, C. L., Advanced Na-cooled power stations, 17: 7622
LARSON, Kermit H., Radioactive I from nuclear tests, 17: 6322 (UCLA-499)
LASLETT, L. Jackson, Electron orbits in magnetic β spectrometer, 17: 6436 (IS-476)
LAUER, E. J., Particle behavior in magnetic mirror geometry, 17: 7465
LAUER, Eugene J., Particle behavior in magnetic mirror and cusp geometries, 17: 7466
LAUFER, Daniel A., Photochemical and radiation-induced reactions, 17: 6146
LAURITA, W., Prog. rpt. on thermionic emitter, 2–5/62, 17: 6788 (EDR-2791)
LAUTZ, G., Thermoelectric power of thin metallic films, 17: 6700 (UCRL-Trans-892(L))
LAWRIE, W. E., Prog. rpt. on coating-metal bonds, 7–9/62, 17: 6509 (ARF-1213-5)
LAWSON, J. D., Versatile cyclotron (70-inch), 17: 7369
LAYTON, J. K., Electron emission from Mo due to noble gas ions, 17: 6855
LAYZER, A. J., One-particle Green's function for many-fermion systems, 17: 6990
LAYZER, A. J., Single-particle excitations in dense electron gas, 17: 6991
LAZAREVA, L. E., Optical anisotropy and shape of surface of atomic nuclei, 17: 7302
LEA, R. M., Isobar pairs in $\bar{p}$-p collisions, 17: 7002
LEARY, J. A., Thermal expansion of PuC and PuC–UC, 17: 6662 (LA-2768)
LEBEDEV, A. I., Scattering of neutrons by Coulomb field, 17: 7074
LEBEDEVA, G. A., Regeneration of G-I tract during radiation sickness, 17: 5929
LEBOWITZ, J. M., n-p Total cross section at 0.4926 and 3.205 Mev, 17: 6976
LE CLAIR, T. G., Status of gas-cooled reactor, 17: 7598 (GA-2566)
LECOMTE, Marcel, Crystalline anisotropy of artificial graphite, 17: 6717
LEE, E., High-temperature compatibility of austenitic stainless steel with CO_2, 17: 6560 (AAEC/E-98)
LEE, Edward K. C., Reactions of recoil T atoms with $C_5H_5PtCl_3$, 17: 6087
LEE, L. L., Jr., Excited states of light nuclei, 17: 6779 (ANL-6603 (p.47-52))
LEE, M. E., Counter for measurement of fast neutron spectra, 17: 6481
LEE, T. D., Boson structures in weak interactions, 17: 6996
LEE, Wonyong, Spin of the K* resonance, 17: 7000
LE FEVRE, B. G., Preferred orientation measurement in U, 17: 6681 (TID-17492)
LEFEVRE, H. W., Fast neutron time-of-flight spectrometer, 17: 6465
LEGERLOTZ, C., Prophylaxis of radiation-conditioned hydronephrosis, 17: 5820
LEGG, James C., Reactions (p,d) and (p,t) on B-11, C-14, O-16, and O-18, 17: 7217
LEHMAN, G. W., Observing virtual localized modes, 17: 6879
LEHMAN, Richard L., Neutron dosimetry with nuclear track emulsion, 17: 6323 (UCRL-9967)
LEHMANN, J., Electron microscope studies of U–Mo alloys, 17: 6712
LEIDER, Marjorie, Distribution of additions in Bi–Cu, Bi–Ag, and Bi–Au, 17: 6683 (UCRL-6452(Pt.II))
LELAND, Thomas W., Jr., Radiation effects on MgO, 17: 6086
LEMAIRE, Remy, Magnetic structure of alloys YCo_5 and $HoCo_5$, 17: 6706
LEMBERG, I. Kh., Cascade Coulomb excitation of rotational levels, 17: 7290
LEMOGNE, Andre, Plastic deformation and rupture of U, 17: 6707
LENCE, J. T., Activation by epithermal and fast neutrons, 17: 7306
LENNOX, Bernard, Damage of chromosomes by doses of radioiodine, 17: 5845
LENNOX, W. C., Extending reactor time-to-poison, 17: 7536 (CRIO-1115)
LEROY, Francis, Oxidation kinetics of Mg, 17: 6577
LETOURNEUR, G., Experimental radiobiology of tumors, 17: 5812
LEUTWYLER, H., Generalized gauge invariance and boson fields, 17: 6969
LEVERETT, M. C., Development of reactor safety standards, 17: 7557 (HW-SA-2507)
LEVIN, I. S., Separation of In and Sn, 17: 6200
LEVINSON, C. A., Nuclear vibrations, rotations, and the shell model. I., 17: 7220
LEVINSON, David W., Structures in Zr–Fe–Sn system, 17: 6527 (TID-7625 (p.30-41))
LEVINSON, I. B., Theory of angular momentum, 17: 7527
LEVY, Charles K., Biological effectiveness of protons and α particles, 17: 5770 (MDC-TDR-62-3)
LEVY, Francoise, Inelastic charge exchange of K^+ mesons, 17: 6966
LEVY, Milton, Oxidation of graphites at elevated temperatures, 17: 6689 (WAL-TR-851.4/2)
LEVY, R. H., MHD-supported hypersonic shock layer, 17: 6783 (BSD-TDR-62-337)
LEWIS, C. L., Extracorporeal irradiation of the blood, 17: 5847
LEWIS, Hazel Loch, Effects of H^3-thymidine on bacteria, 17: 5793
LEWIS, L., Mannesmann rotary piercing of U, 17: 6594 (BRB-66)
LIBUS, Z., Absorption spectra of U(VI) complexes, 17: 6081
LICHTENBERGER, H. V., Prog. rpt. on nuclear superheater, 7–9/62, 17: 7601 (GNEC-254)
LIDEN, Kurt, Standardization of γ sources, 17: 6822
LIEBERMAN, P., Prog. rpt. on reactor containment, 9–10/62, 17: 7532 (ARF-K6018-3)
LIEBMANN, B., Prog. rpt. on fabrication of swaged fuel elements, 4–6/62, 17: 6601 (EURAEC-372)
LIETZ, G. P., Polarization and angular distributions from $Be^9(p,n)B^9$, 17: 7246
LIKHOVIDOVA, E. V., Transport of organic plant substances, 17: 5756
LILHOLT, Hans, Bibliography on dispersion-strengthened materials, 17: 6677 (RISÖ-48)
LIN, S. C., Rate of ionization behind shock waves in air. II., 17: 6773 (AFCRL-62-751)
LIND, D. A., University of Colorado 52-inch cyclotron, 17: 7358
LIND, David A., Field design for Univ. of Colorado cyclotron, 17: 7372
LINDEKEN, C. L., Alpha air monitoring with α/β ratio compensation, 17: 6439 (UCRL-5979)
LINDEROTH, C. E., Fission-product confinement program, 17: 6311 (HW-SA-2843)
LINDGREN, F. T., Vacuum sentinels for ultracentrifuges, 17: 6221
LINDNER, D. W., Double collimator isotope detection of carotid blood flow, 17: 5732
LINDNER, L., Chemical effects of nuclear transformations, 17: 6136
LINDSAY, W. T., Jr., Alpha-β transitions in H-Pd, 17: 6690 (WAPD-T-1268)
LINGAPPA, N., Lifetime of first excited state of Sn-116, 17: 7110 (NP-12330(p.152-7))
LIPPINCOTT, S., Widening Bragg peak in path of charged heavy particles in tissue, 17: 5766 (BNL-5538)
LISSNER, H. R., Double collimator isotope detection of carotid blood flow, 17: 5732
LITMAN, A. P., Corrosion of Ni-base specimens exposed in volatility plant, 17: 6571 (ORNL-TM-411)
LITOVCHENKO, P. G., Gamma conductivity in CdS crystals, 17: 6886
LIVINGSTON, R. S., Concepts of an Mc^2 cyclotron, 17: 7396
LIVINGSTON, R. S., Features in Oak Ridge isochronous cyclotron, 17: 7357
LIVSHITS, L. D., Diagram of state of Ce, 17: 6730
LJUNGGREN, K., Short-lived isotopes as tracers in industry, 17: 6372
LLEWELYN-LEACH, J. S., Effects of H on corrosion mechanism of metals, 17: 6585
LLOYD, Dewi Gerwyn, Curing of silicones by irradiation, 17: 6769
L'NOV, A. N., Decay scheme of K-41, 17: 7177
LOBASHOV, V. M., Spin of Eu-152m, 17: 7287
LOBOV, G. A., Radiative capture of μ^- mesons by protons, 17: 7047
LOCKETT, A. M., Properties of finite nuclei, 17: 7249
LOCKETT, A. M., Reactions $He^3 + t$, 17: 7250

LOCKHART, L. B., Jr., Intercalibration of systems in monitoring fission products, 17: 5753 (NRL-5850)
LOCKHART, R. W., Prog. rpt. on mass transfer in liquid metal systems, 8/1–8/31/62, 17: 6575 (TID-17384)
LOCKHART, R. W., Prog. rpt. on mass transfer in liquid metal systems, 9/1/62–9/30/62, 17: 6576 (TID-17386)
LOCKWOOD, J. A., Forbush decrease measurements, 17: 6929
LOFTS, B., Hormone synthesis by sertoli cells, 17: 5842
LOGACHEV, V. I., Charged particle intensity during space-ship flights, 17: 6935
LOMBARD, David B., Plowshare, 17: 6215
LOMONOSOV, I. I., Scintillation method in radiometry, 17: 6444 (AEC-tr-5259)
LONGEQUEUE, Jean-Pierre, Angular distributions from $B^{11}(p,\alpha_0)$, 17: 7163
LONGEQUEUE, Nicole, Angular distributions from $B^{11}(p,\alpha_0)$, 17: 7163
LOOMIS, B. A., Swelling of U on postirradiation annealing, 17: 6737 (ANL-6532)
LOOS, R., Activation analysis and determination of short-lived isotopes, 17: 6028
LOOS, R., Production and use of Na-24, K-42, Cu-64, and Mo-99, 17: 6171
LORD, R. S., Concepts of an Mc^3 cyclotron, 17: 7396
LORD, R. S., Features in Oak Ridge isochronous cyclotron, 17: 7357
LORD, R. S., Measurement of ORIC magnetic field, 17: 7375
LORQUET, J. C., Energy-transfer and dissociation in excited molecules, 17: 6151
LOSHAK, A. Yu., Radioactive I accumulation in fresh-water fish, 17: 5757
LOUDE, J. F., Efficiency of detector shielding, 17: 7067
LOUDE, J. F., Light yield of solution NE 213 to protons, 17: 6119
LOUTIT, J. F., Immunity to transplantation of bone marrow in irradiated mice, 17: 5916
LOUTIT, J. F., Metabolism of Sr-90 in bone, 17: 5715
LOUTIT, J. F., Movement of Sr in body, 17: 5712
LOUTIT, J. F., Secondary disease among lethally irradiated mice, 17: 5802
LOVBERG, R. H., Instabilities in coaxial plasma gun, 17: 7494
LOWDER, R. S., Fast gas valve for plasma research, 17: 6216
LOZHKIN, O. V., Nuclear structure in high-energy reactions with nuclei, 17: 7186
LU, D. C., Internal conversion coefficients in Sm-152 and Gd-152, 17: 7079 (IS-272)
LUBY, C. S., Evaluation of (Th,U)C_x coated (Th,U)C_x particles, and C coatings, 17: 6655 (GA-3067)
LUCARAIN, Cl., Semi-automatic device for measuring osmotic pressures, 17: 6420
LUCAS, H. F., Jr., Translocation of Th daughters to skeleton, 17: 5707 (TID-15308)
LUCASSON, P. G., Radiation damage in metals, 17: 6732 (62-GC-207)
LUCASSON, P. G., Radiation damage in metals, 17: 6733 (62-GC-209)
LUCCIO, A., Relativistic cyclotron, 17: 7361
LUCKS, C. F., Thermal radiative properties of materials, 17: 6650 (DMIC-177(Vol.I))
LUDOVICI, Peter P., Radiation sensitivity of female genital cancers, 17: 5865
LUDWIG, H., Thrombotic disorder arising from Ra treatment, 17: 5818
LUKE, C. L., Determination of refractory metals in ferrous alloys, 17: 5997
LUNDGREN, Thomas S., Equilibrium of electron beam in plasma, 17: 7424 (DCAS-TDR-62-42)
LUNDIN, Charles E., Prog. rpt. on Nb-rich region of ternary phase diagrams, 6/1–9/1/62, 17: 6652 (DRI-2057)
LUNSFORD, Jack H., Radiation effects on MgO, 17: 6086
LURA, George H., Calibration of Bridgman anvils, 17: 6410 (UCRL-9807)
LUSHBAUGH, C. C., Arm counter in blood clearance studies, 17: 5677 (TID-14613)
LUTHRA, J. M., Radiation damage in calcite, 17: 7136 (NP-12330 (p.429-31))
LUTSENKO, V. N., Gamma and internal conversion spectra in Gd isotopes, 17: 7175
LYASS, F. M., Device for opening metal container with radioactive isotopes, 17: 6214
LYMAN, Taylor, Machining difficult alloys, 17: 6608
LYNN, Y. M., Steady MHD flow past non-conducting wedge, 17: 6898
LYON, J. S., Observations on personnel working with F, 17: 5725
LYUTAYA, M. D., Preparation of Ce nitrides, 17: 6100

M

MAC DONALD, M. C., Gas-flow counting of C-14 compounds, 17: 6470
MAC DONALD, William M., Comments on paper by Hess and Poirier, 17: 6930
MAC DONALD, William M., Diffusion of electrons in Van Allen belt. I., 17: 6924
MAC DONALD, William M., Diffusion of electrons in Van Allen belt. II., 17: 6925
MAC DONALD, William M., Diffusion of electrons in Van Allen belt, 17: 6941
MAC INTYRE, M. Neal, Anomalies in chromosomes following large doses of I-131, 17: 5836
MAC KENZIE, K. R., Characteristics of UCLA cyclotron r-f system, 17: 7377
MACLEOD, N., Local heat-transfer coefficients in nuclear reactor, 17: 6236
MAC MILLAN, Donald P., Material for nuclear rockets, 17: 6547
MADDOCK, R. S., Prog. rpt. on nuclear chemistry, 11/61–10/62, 17: 6132 (TID-17272)
MAECK, William J., Photometric determination of B, 17: 5998
MAEHL, Richard, Preparation and properties of kryptonates, 17: 6364 (NYO-9720)
MAGEE, John L., Energy-transfer and dissociation in excited molecules, 17: 6151
MAHADEVAN, E. G., Hydrogen isotope exchange with aqueous suspensions of catalysts, 17: 6098
MAHADEVAN, P., Electron emission from Mo due to noble gas ions, 17: 6855
MAHUNKA, Imre, Nuclear reactions in Li-6 by protons, 17: 7200
MAILLE, C., Specific gravity of H_2O–steam emulsion, 17: 6378
MAISEYTSEV, P. I., Radiation safety in prospecting of minerals, 17: 6342
MAJUMDAR, A. S. Ghosh, Kinetics of reaction between Pu(III) and Cl, 17: 6057 (AEC-tr-5552)
MALAKOV, I. Yu., Proton scattering by B-10, 17: 7176
MALAT, V., Theory of secondary electron emission, 17: 6832
MALIK, F. B., Variational method for nonrelativistic scattering. I., 17: 7507
MALKOVA, D., Effect of x radiation on spread of encephalitis virus, 17: 5786
MALM, J. G., Vapor pressure and transition points of TcF_6, 17: 6083
MALOVETSKAYA, V. M., Radiation defects in Si, 17: 6767
MALTSEVA, N. S., Formation of At-209 and At-207, 17: 7276
MALVANO, R., Applications of short-lived radionuclides in activation analysis, 17: 6031
MALYUTA, Yu. M., Analytic properties of partial amplitudes, 17: 7028
MANDI, Erika, Plasma-Fe concentration in irradiated animals, 17: 5826
MANDL, Anita M., X-ray sterilization of female rats, 17: 5838
MANESS, R. F., Materials for reactor fuel dissolvers, 17: 6566 (HW-SA-2307)
MANGAL, S. K., Thermal neutron activation cross sections, 17: 7100 (NP-12330(p.95-6))
MANJOINE, M. J., Biaxial brittle fracture tests, 17: 6245 (NP-12374)
MANN, J. E., Beam in cyclotron Analogue II, 17: 7399
MANN, J. E., Concepts of an Mc^3 cyclotron, 17: 7396
MANN, L. G., Electron spectrum observed on Discoverer satellites, 17: 6917 (UCRL-6792-T)
MANN, Lewis T., Jr., Prog. rpt. on tissue transplantation, 6/61–5/62, 17: 5762 (AD-276039)
MANNING, D. L., Determination of Th^{+4}, 17: 5995
MANSARD, B., Prog. rpt. on forming and irradiation of UC, 1–3/62, 17: 6533 (EURAEC-325)
MANTESCO, C., Radiolytic oxidation of p-xylene, 17: 6143
MAPOTHER, D. E., Isotope effect in superconducting Rh, 17: 6872
MARCINOWSKI, H. J., Production and application of radionuclides in Europe, 17: 6156
MARCUM, J. I., Propagation of γ rays near air-ground interface, 17: 6955 (RM-3399-PR)

MARCUS, Y., Anion exchange of metal complexes. X., 17: 6181 (IA-780)
MARCUS, Y., Anion exchange of metal complexes. XIII., 17: 6182 (IA-783)
MARCUS, Y., Solvent extraction of inorganic species, 17: 6179 (IA-740)
MARGARIA, R., Problems of human survival in outer space, 17: 5868
MARINARO, F. F., Prog. rpt. on dielectric to metal seal technology, 3/19/62–6/31/62, 17: 6676 (RADC-TDR-62-401)
MARINELLI, L. D., Translocation of Th daughters to skeleton, 17: 5707 (TID-15308)
MARK, Robert, Tensile fatigue of 305 stainless steel, 17: 6663 (MATT-154)
MARKOV, V. K., Diagram of state of Ce, 17: 6730
MARKOVIC, V., Reactor radiation dosimetry, 17: 6452
MARKOWITZ, Samuel S., Elastic scattering of 31-Mev He^3 ions, 17: 7148 (UCRL-9996)
MARKS, Sidney, Thyroid adenomas in sheep fed I-131, 17: 5768 (HW-SA-2493)
MARONI, P., Electron distribution function in discharge. I., 17: 7451
MARQUES, A., Multiple scattering measurements, 17: 6954 (NP-12259)
MARSHALL, Donald George, Irradiation of spheroidal bodies, 17: 6224
MARSHALL, J. H., 25-Input pulse-height recording system, 17: 6423
MARSHALL, L., Elements in region of Pt formed by fusion in fission explosions, 17: 7242
MARSHALL, M. B., Features in Oak Ridge isochronous cyclotron, 17: 7357
MARSHALL, M. B., Measurement of ORIC magnetic field, 17: 7375
MARTENS, B. K., Survival rate and sexual sterilization of granary weevil, 17: 6368
MARTENS, H. E., Tensile properties of low-alloy and stainless steels, 17: 6661 (IPL-TR-32-222)
MARTIN, J. A., Beam in cyclotron Analogue II, 17: 7399
MARTIN, J. A., Concepts of an Mc^2 cyclotron, 17: 7396
MARTINS, Oliver, Neutron cross sections of Pr, Yb, and Lu, 17: 7078 (IEA-51)
MASH, Donald R., Conference on materials science, 17: 6541
MASH Donald R., Plasma-arc spraying of materials, 17: 6556
MASIRONI, R., Effects of tritiated H_2O on *Rhodotorula gracilis*, 17: 5719
MASON, Dean T., Radioisotope scanning of precordial distribution of I, 17: 5685
MASON, G. W., Extraction of Th(IV) as mixed complex, nitrate or chloride, 17: 6189 (TID-15313)
MASON, G. W., Synergistic effects in extraction of selected metallic cations, 17: 6188 (TID-15271)
MASTRUP, F., Ambipolar diffusion of plasma in weak magnetic field, 17: 7454
MATERSON, K. S., Jr., Properties of finite nuclei, 17: 7249
MATETSKAYA, T. E., Peripheral blood action of radiation, 17: 5850
MATHER, George, Anoxic protection of small intestine by intra-arterial catheterization, 17: 5667 (BNL-5798)
MATSUDA, Kazuhisa, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
MATSUI, Eiichi, Cathodeluminescence of BeO, 17: 6089
MATSUOKA, S., Bone marrow of A-bomb survivors, 17: 5785
MATSUURA, H., Exposure dose of radiology patients, 17: 6348
MATTHES, Franz, Determination of Hf and Zr, 17: 6002
MATTHEWS, R., Charged particle intensity during space-ship flights, 17: 6935
MATTHIAS, B. T., Superconductivity of solid solutions of noble metals, 17: 6860
MATTIS, D. C., Theory of magnetothermomechanics, 17: 6859
MATTKHIZ, Z., Normalized α widths in α model, 17: 7189
MAURMEYER, Robert, Progress in quantitative analysis, 1961, 17: 6006
MAXIMOV, M. Z., Calculations of intranuclear cascade, 17: 7183
MAXSON, W. J., End milling U-500 alloy, 17: 6614
MAXSON, W. J., Machining Hastelloy X, Rene 41, and HS-25 alloys, 17: 6611
MAY, G. H., Annealing of quenched U–Mo alloy, 17: 6716
MAYCOCK, J., Magnetohydrodynamic power generation, 17: 6849
MAYDAN, Dalish, Anion exchange of metal complexes. X., 17: 6181 (IA-780)
MAYER, L., Rotation levels of Er-168, 17: 7270
MAYNARD, J. M., Computer program for orbit stability in circular accelerators, 17: 7345 (TID-15535)
MAZEY, D. J., Interstitial dislocation loops in Al, 17: 6765
MC CABRIA, J. L., Prog. rpt. on solar thermoelectric generator, 2–5/62, 17: 7642 (AD-276092)
MC CAIN, W. M., Hydriding procedures, 17: 6649 (DC-61-7-26)
MC CAIN, W. M., Production of massive hydrided Zr, 17: 6595 (DC-61-7-18)
MC CALL, Richard C., Standardization of γ sources, 17: 6822
MC CANCE, R. A., Metabolism of Ca in perinatal period, 17: 5731
MC CARTY, S., Synergistic effects in extraction of selected metallic cations, 17: 6188 (TID-15271)
MC CLELLAN, R. O., Reproductive performance of swine ingesting Sr-90, 17: 5700 (HW-74969)
MC CONNELL, Harden M., Irradiated organic inclusion compounds, 17: 6162
MC CONOMY, Jeanne M., Biological effectiveness of protons and α particles, 17: 5770 (MDC-TDR-62-3)
MC COWN, J. J., Determination of Fe in U–fission element alloys, 17: 5978 (TID-15319)
MC DONALD, F. B., Solar flare of September 28, 1961, 17: 6921
MC DONELL, W. R., Irradiation growth in U, 17: 6762
MC DUFFIE, G. E., Jr., Ferromagnetic resonance in garnets, 17: 6042 (NOL-TR-62-34)
MC EWEN, J. G., Elastic μ^- scattering in nuclear emulsion, 17: 6988
MC GONNAGLE, Warren J., Ultrasonic "jack hammer" developments, 17: 6201 (ANL-FGF-300)
MC GUIRE, E. J., Photoelectric K-absorption cross section of Be, 17: 6870
MC GURTY, James A., Cladding alloys for reactor applications, 17: 7571 (TID-17402)
MC HUGH, James A., Correlation of β^+ annihilation rates in metals, 17: 6960 (UCRL-9793)
MC KAY, C. D., Neutron flux distributions in cylinders, 17: 7062
MC KINLEY, J. M., Determination of ρ,γ,π coupling constant, 17: 7001
MC LEMORE, T. A., Copper-64 in study of reaction mechanisms of enzymes, 17: 5696
MC LENEGAN, D. W., Application of external energy absorbers to large fission product shipping casks, 17: 6352
MC LENEGAN, D. W., Fission product casks and containers, 17: 6244 (HW-SA-2807)
MC MASTERS, A., Fall velocity of fallout particles, 17: 6303 (AD-276121)
MC MASTERS, O. D., Thorium–Mo phase diagram, 17: 6659 (IS-442)
MC NAUGHTON, G. S., Radioactive fallout in New Zealand. II., 17: 5758
MC NEILL, K. G., Excretion of Cs-137 in humans, 17: 5713
MC NULTY, J., Lifetimes of 246- and 46.7-kev transitions in Po-210, 17: 7245
MEADOWS, J. W., Ferroelectric solid solutions possessing relatively large spontaneous polarizations, 17: 6678 (TID-14508)
MEDVED, D. B., Electron emission from Mo due to noble gas ions, 17: 6855
MEERT, M., Nuclear recoil effect on ionization, 17: 7154
MEHR, David L., Fabricating liquid H targets from Mylar, 17: 6808 (UCRL-9824)
MEIER, H., Description of cosmic-ray jet, 17: 6919
MEINKE, W. Wayne, Handling and separation of short-lived radioisotopes, 17: 6133 (TID-17337)
MEINKE, W. Wayne, Prog. rpt. on nuclear chemistry, 11/61–10/62, 17: 6132 (TID-17272)
MEINKE, W. Wayne, Vacuum distillation and radiochemical separations, 17: 6135
MEKHEDOV, V. N., Formation of At-209 and At-207, 17: 7276
MELEHAN, James B., In-pile fission gas release apparatus, 17: 6202 (BMI-X-216)
MELIORANSKII, A. S., Gamma-γ coincidences in $Ag^{107}(n,\gamma)Ag^{108}$, 17: 7285
MELKONIAN, E., n-p Total cross section at 0.4926 and 3.205 Mev, 17: 6976
MELLETT, P. G., Inhibition of x-ray damage to guinea pig skin, 17: 5915
MENDES, J. Amaral, Cattle and sheep thyroid activity, 17: 5740
MENDES, J. Amaral, Determination of Sr-90 in bone. I., 17: 5741
MENDES, J. Amaral, Radioiodine in thyroid glands, 17: 6354
MENNA, F., Ocular hypertonia induced by x irradiation, 17: 5794
MENON, K. K., Prog. rpt. on fallout, 12/31/61, 17: 6272 (ORO-520)
MERCKX, K. R., Deformation of shaped cylindrical fuel elements, 17: 7543 (HW-70501)

MERCKX, K. R., Distortion of helical wire wrappings, 17: 6743 (HW-SA-2445)
MERINIS, Jean, Gamma radiation during decay $Th^{234} \rightarrow Pa^{234}$, 17: 7160
MERRITT, Charles, Jr., Separation of complex mixtures, 17: 6000
MERRITT, M. L., Pressures as affected by hills and dales, 17: 6276 (WT-502)
MERTEN, U., Prog. rpt. on chemistry of fission product elements, 8/59-7/60, 17: 6036 (GA-1536)
MERY, Elena, Polymerization of ribomononucleotides by γ radiation, 17: 5791
MESCHI, D. J., Thermodynamic functions for solids, 17: 6108
MESHCHERYAKOV, M. G., Amplitudes of nucleon-nucleon scattering, 17: 7080 (JINR-P-1024)
MESHCHERYAKOV, M. G., Elastic scattering of protons by carbon nuclei, 17: 7081 (JINR-P-1025)
MESHCHERYAKOV, V. A., Effect of $\pi\pi$ interaction on πN scattering, 17: 7024
MESHCHERYAKOV, M. G., Triple scattering of 660-Mev protons. III., 17: 7041
MESHKOV, S., Nuclear vibrations, rotations, and the shell model. I., 17: 7220
MESHKOVSKII, A. G., Generation of π^0 mesons in Coulomb field of nucleus, 17: 7020
MESHKOVSKII, A. G., Resonance in $K^0\bar{K}^0$ pair production, 17: 7039
METCALF, W. K., Changes in erythrocytes following whole-body radiation, 17: 5843
METCALFE, J., Determination of B in Zr metal, 17: 5970 (PG-Report-391)
METZ, D. J., Gamma-induced polymerization of α methyl styrene, 17: 6124 (BNL-5838)
MEYER, H., Radiation research and treatment, 17: 5698
MEYER, Irving, Effects of 200 kv and Co-60 radiation on jaws and dental structure, 17: 5867
MEYER, Paul, Prog. rpt. on pulsed neutron application to reactor startup, 17: 7541 (GEAP-4047)
MEYER, R. A., Rapid O diffusion in BeO, 17: 6666 (NAA-SR-7637)
MEYERHOF, W. E., Threshold effects in cross sections according to R-matrix theory, 17: 7236
MEYERHOF, Walter E., Final rpt. on spin-zero states in even-even nuclei, 11/59–10/62, 17: 7075 (AROD-2577:2)
MEYER-SCHUETZMEISTER, L., Excited states of light nuclei, 17: 6779 (ANL-6603(p.47-52))
MEYERSTEIN, D., Charge-transfer complexes of I, 17: 6038 (IA-763)
MICHAEL, D. H., Stability of plane Alfven wave, 17: 6845
MICHAEL, H., Spectrophotometric studies of uranyl ion system, 17: 5955 (JUL-74-PC)
MICHAELIS, Carl, Separation by ion exchange chromatography, 17: 5991
MICHAUD, H., Vaporization of U and U carbides, 17: 6110
MICHIE, Richard W., Interplanetary gas. VII., 17: 6909
MICKLEM, H. S., Immunity to transplantation of bone marrow in irradiated mice, 17: 5916
MICKLEM, H. S., Secondary disease among lethally irradiated mice, 17: 5802
MICKLES, James, Antiradiation compounds. I., 17: 5924
MIELKEN, G., Rotation levels of Er-168, 17: 7270
MIGDAL, A. B., Theory of Fermi fluid of two types of particles, 17: 7303
MIHELICH, J. W., Lifetimes of 246- and 46.7-kev transitions in Po-210, 17: 7245
MIKHAIL, S. Z., Measurements of Mo(V) solutions, 17: 5996
MIKHAILOVSKII, A. B., Stability of inhomogeneous plasma, 17: 7436 (NP-tr-928)
MIKK, G., Emittance of materials, 17: 6731
MIKUMO, Takeshi, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
MILLER, D., Decays of the ω and η mesons, 17: 6998
MILLER, D., Pion resonances in π^+-p interactions, 17: 6997
MILLER, J., Temperature coefficients in SNAP reactors, 17: 7560 (NAA-SR-7140)
MILLER, Norman F., Radiation sensitivity of female genital cancers, 17: 5865
MILLER, R. I., Prog. rpt. on hydrazine process development, 8–10/62, 17: 6123 (AGN-AN-756)
MILLER, V. B., Diffusion coefficients in polymers, 17: 5943
MILLS, F. E., Beam loading, 17: 7334 (BNL-6511(p.283-8))
MINAMI, Shigeo, Meson reactions at very high energy, 17: 7013
MINAMI, Shigeo, Strange-particle resonant states and meson reactions, 17: 7014
MING, Nam Puk, Formation of At-209 and At-207, 17: 7276
MING, Nam Puk, Reactions (p,xn) and (p,2xn) type on Te isotopes, 17: 7297
MINKKINEN, Carl, Radiological safety at Hardtack, 17: 6317 (OTO-58-3)
MINN, S. S., X-ray fluorescence spectrographic analysis using β source, 17: 5982 (CEA-tr-X-461)
MIRIMOVA, T. D., Radiation injuries of cranial bones in a child, 17: 5849
MIRK, Kenneth F., Mechanical features of r-f system for 88-inch cyclotron, 17: 7347 (UCRL-10065)
MISHAKOVA, A. P., Secondary particles produced in high-energy interactions, 17: 7019
MISHCHENKO, V. T., Determination of rare earths in EOTA complexes, 17: 6010
MISUMI, Seizo, Spectrophotometric determination of Ce, 17: 5988
MITANI, Kenji, Microwave emission of cold plasma, 17: 7435 (AEC-tr-5564)
MITCHELL, John R., Growth of tumors in mice injected with x-irradiated cells, 17: 5824
MITCHELL, K. K., Continuous leak water sampler, 17: 6398 (KY-423)
MITRA, A. N., Binding energy of H-3 and n-d scattering lengths, 17: 7089 (NP-12330(p.15-16))
MITRA, B., Directional neutron counter for fast neutrons, 17: 7118 (NP-12330(p.199-201))
MITRA, B., Total cross sections with 14-Mev neutrons, 17: 7095 (NP-12330(p.61-5))
MITRA, S. K., Beta-γ directional correlation in Eu-154, 17: 7106 (NP-12330(p.132-6))
MITROFANOV, K. P., Shifts of γ transition of Sn-119 in organo-tin compounds, 17: 7281
MITTLEMAN, M. H., Excitation of atomic H by fast protons, 17: 6861
MIXTER, George, Jr., Thermonuclear war, 17: 6347
MIYAGAKI, Morio, Geomagnetic effects of cosmic heavy primary, 17: 6931
MO, Tin, Prog. rpt. on fallout, 12/31/61, 17: 6272 (ORO-520)
MOERK, S. A., Rotating rig for dosimeter calibration, 17: 6475
MOFFAT, J. W., Analytic approximation to inverse amplitude dispersion relations, 17: 7510
MOHINDRA, R. K., Interaction of 14.8-Mev neutrons with Al, 17: 7093 (NP-12330(p.39-45))
MOHR, Harold L., Determination of isodose of pendulum irradiation. VII., 17: 5899
MOINARD, J., Specific gravity of H_2O–steam emulsion, 17: 6378
MOLCHANOVA, V. A., Survival rate and sexual sterilization of granary weevil, 17: 6368
MOLDAUER, P. A., Average resonance parameters and optical model, 17: 7244
MOLITOR, Jerome H., Ion propulsion for control of stationary satellites, 17: 7648
MOLZON, Arnold E., Bibliography on health hazards of plastics, 17: 6318 (PLASTEC-NOTE-5)
MONESI, Valerio, DNA synthesis and cell cycle in spermatogenesis, 17: 5720
MONTAN, D. N., Alpha air monitoring with α/β ratio compensation, 17: 6439 (UCRL-5979)
MONTGOMERY, D. Bruce, Superconducting Nb–Zr solenoids, 17: 6209
MONTGOMERY, Peter W., Calibration of Bridgman anvils, 17: 6410 (UCRL-9807)
MONTGOMERY, R. L., Heat of solution of Ce in HCl, 17: 6033 (BM-RI-6146)
MONTREUIL, M., Yttrium-90 needles in interstitial β therapy, 17: 5695
MOORE, A., Effects of machining and grinding on tensile properties of Be, 17: 6642 (AWRE-O-63/62)
MOORE, H. E., Prog. rpt. on fallout, 12/31/61, 17: 6272 (ORO-520)
MOORE, Horace R., Source and detector of radiation in 1500-50 Å region, 17: 6411 (WADD-TR-60-371)
MOORE, R. H., Cation and anion effects on distribution of U, 17: 6037 (HW-SA-2537)
MOORE, Thomas J., High-N weld metals, 17: 6723
MOOREHEAD, E., Computations for fallout, 17: 5749 (CDRP-182-113)

MOOS, Walter S., X-ray barrier efficiency of building materials, 17: 6720
MORCZEK, A., Surgical treatment of radiation injury, 17: 6325 (JPRS-16072)
MOREH, R., Preparation of thin targets of isotopic O, 17: 5945
MOREIRA, Jaime Araujo, Conversion electron spectrum of W-182, 17: 7161
MORENO, Juan M. Martinez, Prospecting for U, 17: 6284
MORGAN, J. G., Final rpt. on radiation effects on UC, in graphite 1/8/63, 17: 6748 (ORNL-3340)
MORI, C., X-ray fluorescence spectrographic analysis using β source, 17: 5982 (CEA-tr-X-461)
MORI, Kazuo, Hot plasma produced by linear discharge device, 17: 7449
MORIARTY, R., Computations for fallout, 17: 5749 (CDRP-182-113)
MOROI, David S., αZ correction to Bethe-Maximon pair production cross section, 17: 6948 (IS-429)
MOROSHKINA, T. M., Concentration of U on ion exchange resins, 17: 6013
MORPURGO, M., Isochronous cyclotron meson factory, 17: 7395
MORRIS, D. J., Saturation pool boiling burnout at atmospheric pressure, 17: 6241
MORRIS, John McLean, Cytologic response in radiation of cancer, 17: 5864
MORRIS, T. W., Isobar pairs in p-p collisions, 17: 7002
MORRISON, G. C., Cross sections and angular distributions from Li–Li nuclear reactions, 17: 7251
MORRISON, H. A., Deuterium exchange by diazo-acetyl group, 17: 6067
MORROW, F., Effects of machining and grinding on tensile properties of Be, 17: 6642 (AWRE-O-63/62)
MORSE, Fred A., Scattering of atomic beams of K and Cs by Hg, 17: 6836
MOSIN, A. F., Radioprotective action of pyridoxine and its S derivative, 17: 5930
MOSSER, J. S., Thermodynamic properties of SiF_4, 17: 6056 (WRU-202)
MOSZKOWSKI, S. A., Energy distribution of terms and line arrays in atomic spectra, 17: 6798 (RM-2947-AEC)
MOTE, Jim D., Yield strength of Ag–Al, 17: 6685 (UCRL-9992)
MOTT, W. E., Oxygen content of organic materials, 17: 5993
MOTZKUS, Friedrich, Dose capacity measurements in environment of I-131 patients, 17: 6360
MOUTON, W. L., Nuclear resonant scattering of γ radiation, 17: 7229
MUELLER, Herbert J., Exo-electron emission, 17: 6789 (ERDL-1704-RR)
MUELLER, M. H., Crystal structure variations in alpha U at low temperatures, 17: 6721
MUELLER, W., Design of spiral ridge cyclotron, 17: 7397
MUENCH, Guido, Intensity of forbidden emission lines, 17: 6903
MUKHERJEE, S. N., Photodisintegration of He, 17: 7238
MUKHTAROV, A. I., Polarization effects in decay of π mesons, 17: 7021
MURBACH, E. W., Oxidation of UC by CO_2, 17: 6665 (NAA-SR-7482)
MURDOCK, David M., Brazing thin Be windows, 17: 6605
MURPHY, E. A., Helical finned tube development, 17: 6599 (TID-17340)
MURPHY, Richard J., Strengthening mechanisms of dispersion-strengthened alloys, 17: 6591 (ASD-TDR-62-734)
MURRAY, J. D., Strong cylindrical shock waves in magnetogasdynamics, 17: 6844
MURRAY, John G., Voltage doubler rectifier, 17: 6400 (MATT-110)
MURRENHOFF, A., Spectrophotometric studies of uranyl ion system, 17: 5955 (IUL-74-PC)
MUSIL, F. J., Modifications of cylindrical powder diffraction camera, 17: 6392 (GAT-T-973)
MUSS, Daniel R., Deuteron-irradiated W, 17: 6736 (AFCRL-62-515)
MUTH, H., Prophylaxis of radiation-conditioned hydronephrosis, 17: 5820
MYERS, H. P., Radiation effects in structural materials, 17: 6735 (AE-90)
MYERS, I. T., Input and source impedance corrections in voltmeter standardization, 17: 6395 (HW-SA-2510)
MYERS, William G., Iodine-125 for labeled hippuran renogram, 17: 5728
MYHRER, T[orleif] H., Services for Berkeley cyclotron, 17: 7414

N

NABICHVRISHVILI, V. A., Cascade Coulomb excitation of rotational levels, 17: 7290
NACHTIGALL, D., Practical neutron dosimetry, 17: 6437 (JÜL-69-ST)
NAGAMATSU, H. T., Non-linear conductivity of plasma for MHD power generation, 17: 7491
NAGANO, Norimitsu, Spectrophotometric determination of Ce, 17: 5988
NAIR, K. G., Emission of α particles in fission process, 17: 7097 (NP-12330(p.71-8))
NAITO, Y., Exposure dose of radiology patients, 17: 6348
NAITO, Yoshikido, Absorption of H, and D, by Ti, 17: 6699 (SCL-T-451)
NAKAGAWA, Masuo, Cathodeluminescence of BeO, 17: 6089
NAKAGAWA, S., Gonadal exposure dose in x-ray examination, 17: 6351
NAKAGAWA, S., Gonadal exposure in the infant, 17: 6352
NAKAJIMA, Yutaka, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
NAKATANI, R. E., Effect of chronic feeding of Sr^{90}–Y^{90}, 17: 5701 (HW-SA-2255)
NAKATANI, R. E., Force-feeding radioisotopes to yearling trout, 17: 5738
NAKAYAMA, Kiyoshi, e-μ Transitions induced by electromagnetic interactions, 17: 7009
NAMBOODIRI, M. N., Extraction of Th(IV) as mixed complex, nitrate or chloride, 17: 6189 (TID-15313)
Nam Puk, Ming
see Ming, Nam Puk
NARATH, A., Automatic scanner for nuclear emulsions, 17: 6476
NARLIKAR, J. V., Neutrinos and arrow of time in cosmology, 17: 7005
NARTOVA, T. T., Elastic properties of Al–Ti alloys, 17: 6709
NASH, W. F., Sea-level momentum spectra of muons, 17: 6918
NATH, A., Directional neutron counter for fast neutrons, 17: 7118 (NP-12330(p.199-201))
NATH, A., Small-angle coherent scattering of γ rays, 17: 7111 (NP-12330 (p.158-61))
NATH, Amar, Annealing radiation damage of (n,γ) reaction, 17: 7135 (NP-12330(p.422-8))
NATH, Amar, Annealing radiation damage of (n,γ) and (γ,n) reactions, 17: 7134 (NP-12330(p.415-21))
NATH, N., Neutron inelastic scattering cross sections in Pb isotopes, 17: 7099 (NP-12330(p.86-94))
NATHANS, M. W., Thermal decomposition of the rare earth sulfates, 17: 6054 (UCRL-6500)
NATHANS, Marcel W., Distribution of additions in Bi–Cu, Bi–Ag, and Bi–Au, 17: 6683 (UCRL-6452(Pt.II))
NATHANS, Robert, Spin density distributions and Hartree-Fock calculations for Fe group series, 17: 6646 (BNL-5679)
NAUENBERG, M., Relation between binding energy and coupling constant, 17: 6943 (BNL-5517)
NAUENBERG, U., Decays of the ω and η mesons, 17: 6998
NAUENBERG, U., Pion resonances in π^+-p interactions, 17: 6997
NAUMER, Dale A., Prog. rpt. on solar thermoelectric generator, 2–5/62, 17: 7642 (AD-276092)
NAVRATIL, E., Direct photonuclear reactions (γ,n) and (γ,p), 17: 7167
NAZARENKO, V. A., Spin of Eu-152m, 17: 7287
NEAL, R. B., Long iris-loaded linacs, 17: 7320 (BNL-6511(p.128-61))
NEAL, R. B., Superconducting linacs, 17: 7325 (BNL-6511(p.196-203))
NEEL, J. V., Maternal radiation and mongolism, 17: 5848
NE'EMAN, Y., Protonium two-meson annihilation, 17: 6947 (IA-768)
NEGOESCO, I., Radiolytic oxidation of p-xylene, 17: 6143
NEHRU, A. Y., Effects of H on corrosion mechanism of metals, 17: 6585
NEIDIGH, R. V., Ionic sound waves in plasmas, 17: 7470
NEIMAN, M. B., Competing reactions involving radicals, 17: 6071
NEIMAN, M. B., Diffusion coefficients in polymers, 17: 5943
NELSON, R. William, Measurement of permeability in heterogeneous media. III., 17: 6790 (HW-SA-2405)
NEMEC, J., Polarization of protons scattered on C, 17: 7166
NEMODRUK, A. A., Determination of B in BeO, 17: 6015
NESTEROV, V. Ye., Cosmic ray equator from satellite data, 17: 6938
NESTEROV, V. Ye., Outer radiation belt of earth at 320 km, 17: 6936
NETTESHEIM, P., Polycythemia vera, 17: 5687
NEUDACHIN, V. G., Normalized α widths in α model, 17: 7189
NEUMANN, Gerhard, Roentgen diagnosis and incidence of leukemia, 17: 5816
NEUMANN, O., Prog. rpt. on fabrication of swaged fuel elements, 4–6/62, 17: 6601 (EURAEC-372)
NEUMEISTER, K., Surgical treatment of radiation injury, 17: 6325 (JPRS-16072)
NEVES, Eline M., Determination of Sr-90 in bone. I., 17: 5741
NEVZGODINA, L. V., Tomato mutants induced by γ radiation, 17: 5892
NEWBURY, R. S., Vaporization of Gd and Th dicarbides, 17: 6109

NEWBY, Noel D., Jr., Scattering in K=0 band of deformed nuclei, 17: 7146 (UCRL-9764)
NEWCOMB, William A., Lagrangian and Hamiltonian methods in MHD, 17: 7430 (UCRL-6387)
NEWMAN, E., Nitrogen nucleus reactions with B-11, F, Al, Si, P, and Cl, 17: 7252
NEWTON, Ames S., Radiolysis of liquid isobutane, 17: 6134 (UCRL-9924)
NGUYEN, Van-hieu, Amplitudes of π-meson production, 17: 7023
NGUYEN, Van-hieu, Neutral currents in neutrino experiments, 17: 7037
NICHOLS, Maurice William, Fuel element charging and discharging arrangements, 17: 7590
NIELSEN, Julian M., Removal of radioisotopes from Columbia River, 17: 6310 (HW-SA-2411)
NIELSEN, N., Anoxic protection of small intestine by intra-arterial catheterization, 17: 5667 (BNL-5798)
NIEMANN, E. G., Determination of γ attenuation factors of shielding materials, 17: 7501
NIJS, W. W., Spectral Shift Reactor, 17: 7580
NIKITIN, M. K., Lifetimes of excited states Dy-160, Lu-175, Hf-177, and Ir-191, 17: 7292 8-
NIKITIN, S. Ya., Multiple production of π mesons in πp collisions, 17: 7035
NIKITIN, Yu. P., Generation of π^0 mesons in Coulomb field of nucleus, 17: 7020
NIKITIN, Yu. P., Inelastic diffraction at high energies, 17: 7522
NIKOLSKII, B. A., Secondary particles produced in high-energy interactions, 17: 7019
NIKOL'SKII, V. D., Formation of plutonyl complexes in HNO_3, 17: 6191 (CEA-tr-R-1514)
NILSSON, Agnar, Bone and marrow changes induced by Sr-90, 17: 5907
NILSSON, I., Gamma spectrum of Swedish Laplanders, 17: 5763 (AE-80)
NISHIDA, Yoshihiko, Inelastic scattering of high-energy nucleons, 17: 7265
NIX, J., Prog. rpt. on fallout, 12/31/61, 17: 6272 (ORO-520)
NOHARA, N., Efficiency in liquid scintillation counting, 17: 6454
NONAKA, Itoro, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
NOSOV, V. G., Depolarization of μ^+ mesons in solids, 17: 7046
NOVAK, Z., Disintegration of C-12 into three α particles, 17: 7288
NOVICHKOVA, A. T., Radiation effects on N metabolism in yeast cells, 17: 5881
NOVIKOV, P. D., Radiation synthesis of ion-exchange sorbents, 17: 6140
NOVIKOV, Yu. V., Effect of natural radioactivity on population's health, 17: 6341
NOWAK, K., Elementary particles and photron theory. II., 17: 6972
NOWOTNY, H., Frictional pyrophoricity of alloys, 17: 6693 (AEC-tr-5544)
NOWOTNY, H. E., Recrystallization on Zn by thermal cycling, 17: 6698 (NP-tr-929)
NUCKOLLS, M. J., Zinc bromide shielding window, 17: 7498 (USNRDL-TR-594)
NURUSHEV, S. B., Amplitudes of nucleon-nucleon scattering, 17: 7080 (JINR-P-1024)
NURUSHEV, S. B., Elastic scattering of protons by carbon nuclei, 17: 7081 (JINR-P-1025)
NURUSHEV, S. B., Triple scattering of 660-Mev protons. III., 17: 7041

O

OBERHOFER, M., Shielding of radiations from reactor-beam tubes, 17: 7503
O'BRIEN, B. J., Solar protons and magnetic storms, July 1961, 17: 6920
OEHME, Reinhard, Moving poles and elementary particles, 17: 7004
OESCHGER, H., Measurement limits of weak activity, 17: 6449
OESTBERG, G., Composition of second phase in Zy, 17: 6719
OGARD, A. E., Thermal expansion of PuC and PuC–UC, 17: 6662 (LA-2768)
OGDEN, H. R., Prog. rpt. on refractory metals rolling, 17: 6597 (DMIC-176)
OGIBALOV, P. M., Strength of shells exposed to irradiation, 17: 6754 (FTD-TT-62-719)
OGIEVETSKII, V. I., Interference phenomena in $K^0\bar{K}^0$ systems, 17: 7026
O'HALLORAN, Thomas, Spin of the K^* resonance, 17: 7000
O'HARA, C. F., Friction phenomena in space, 17: 6548
OHLBAUM, Adele, Polymerization of ribononucleotides by γ radiation, 17: 5791
OHMURA, Takashi, Quantum theory of scattering, 17: 7053
OHNUKI, Yasushi, Human and monkey leukocytes in culture, 17: 5676 (SAM-TDR-62-99)
OHNUMA, S., Conference on linear accelerators, 8/62, 17: 7308 (BNL-6511)
OHNUMA, S., Phase oscillation and transverse focusing, 17: 7314 (BNL-6511(p.65-75))
OKAMOTO, Kousuke, Hot plasma produced by linear discharge device, 17: 7449
OKAMURA, S., Radiation-induced solid state polymerization, 17: 6155
OKOLOVICH, V. N., Kinetic energy of fragments in subbarrier fission, 17: 7300
OKUDA, Haruyuki, Electronic components in galactic cosmic rays, 17: 6939
OKUN, L. B., Gravitational interaction of fermions, 17: 7049
OKUN, L. B., Possible decays of new mesons, 17: 7022
OKUN, L. B., Theory of weak interactions: 13 lectures, 17: 6962 (AEC-tr-5226)
OLANDER, D. R., Diffusion in mixed solvents, 17: 6060
OLESON, Norman L., Diagnostic measurements on P-4 steady-state plasma, 17: 7432 (UCRL-6562)
OLINE, L. W., Transient heat transfer in micromodules, 17: 6229 (SCTM-233-62(14))
OLIPHANT, Thomas A., Extrapolation procedure for linear systems, 17: 6502 (TID-14532)
OLIVER, R., Extracorporeal irradiation of the blood, 17: 5847
OLIVER, R., Metal compensators for tissue heterogeneity in radiotherapy, 17: 5680
OLLEY, J. W., Model for meson production in high-energy N-N collisions, 17: 6984
OLSON, D. M., Reflecting microscope for temperatures to above 2500°C, 17: 6406 (TID-13148)
OLSON, P. A., Antibiotic resistance and radiation induced mutation in *C. columnaris*, 17: 5769 (HW-SA-2540)
ONCESCU, M., Radioactive tracers in study of subterranean water flow, 17: 6377
ONDOH, Tadanori, Geomagnetic disturbances at the auroral zone. II., 17: 6838
O'NEILL, R. A., Brazing Be for aerospace applications, 17: 6607
ONO, Kan-ichi, Decay interaction of baryons, 17: 7016
ONSTOTT, E. I., Preparation of lanthanon acetates, 17: 6082
OORT, Abraham H., Meridional circulation in stratosphere during IGY, 17: 6274 (TID-17467)
OPPLIGER, L. D., Proton-oxygen differential scattering cross sections. III., 17: 7228
OREAR, J., Elastic μ^- scattering in nuclear emulsion, 17: 6988
ORECHER, S., Shielding of radiations from reactor-beam tubes, 17: 7503
ORLOV, Yu. F., Stable betatron oscillations, 17: 7417
ORMAN, Stanley, Photochemical and radiation-induced reactions, 17: 6146
ORTH, C. J., Decay of fission product Sn and Sb isotopes, 17: 7139 (TID-14799)
ORTNER, J., Geomagnetic storm sudden commencement, 17: 6928
OSBORNE, M. F., Final rpt. on radiation effects on UC, in graphite 1/8/63, 17: 6748 (ORNL-3340)
OSIPOV, B. D., Magnetic constriction of electron-hole plasma, 17: 7479
OSTROUMOV, V. I., Disintegration of C-12 into three α particles, 17: 7288
OTLET, R. L., Harwell Cs-137 beam therapy unit Mk II, 17: 5764 (AERE-R-3334)
OTT, Werner, Plasma boundary layer in a low-pressure discharge, 17: 7476
OTTEWILL, R. H., Interaction of myristic acid monolayers with Th, 17: 6079
OWENS, H. C., Calculating cyclotron orbits, 17: 7384
OXENIUS, J., Nonthermal impurity radiation from spherical plasma, 17: 7464
OXFORD, Carl J., Jr., Drilling hardened Rene 41 alloy, 17: 6616
OXFORD, Carl J., Jr., End milling hardened Rene 41 alloy, 17: 6613

P

PABLO, M. R., Critical magnetic fields of superconducting Mo, 17: 6857
PACE, E. L., Thermodynamic properties of SiF_4, 17: 6056 (WRU-202)
PADDLEFORD, D. F., Measurements of Mo(V) solutions, 17: 5996

PADMANABHAM, A. A., Beta-γ circular polarization correlation in Eu-152, 17: 7107 (NP-12330(p.137-40))
PADMORE, G. R. A., Trolley for radioactivity measuring equipment, 17: 6213
PAIDASSI, Jean, Oxidation kinetics of Mg, 17: 6577
PAINE, R. M., Prog. rpt. on intermetallic compounds, 7–9/61, 17: 6643 (BBC-112)
PAL, L., Statistical theory of neutron chain reactions. III., 17: 7061
PAL, L., Statistical theory of neutron chain reactions. I., 17: 7059
PAL, L., Statistical theory of neutron chain reactions. II., 17: 7060
PALKINA, N. A., Oxidative metabolism in *Staphylococcus aureus*, 17: 5790
PALMER, H. B., Prog. rpt. on graphite, 4/1/62–3/31/63, 17: 6531 (TID-17504)
PALMER, P. E., Thorium–Mo phase diagram, 17: 6659 (IS-442)
PANDARESE, F., Tunnel diode fast discriminator circuit, 17: 6399 (LNF-62/73)
PANDE, S. V., Effect of x radiation on hepatic synthesis of fatty acids, 17: 5792
PANISH, M. B., Prog. rpt. on thermodynamics of refractory compounds, 9-11/62, 17: 6045 (RAD-SR-62-251)
PANTYUSHIN, A. A., Resonance interactions of K mesons, 17: 7043
PAOLETTI, P., Morphology of "drumsticks" in the rabbit, 17: 5798
PAOLETTI, P., Rabbit "drumsticks" after pan irradiation, 17: 5797
PAPACOSTA, John P., Brazing thin Be windows, 17: 6605
PAPOUSEK, F., Rabbit kidney after x irradiation, 17: 5904
PAQUETTE, Guy, Radiative capture of 1S orbital electrons, 17: 7158
PARCHWITZ, Heinz-Karl, Radiation effects on glucose and fatty acid transport in small intestine, 17: 5933
PARDO, Marie-Paule, Oxytellurides of rare earths, 17: 6068
PARFENOV, Yu. D., Handbook on toxicology of radioisotopes, 17: 5748
PARFENOV, Yu. D., Radiation-induced chemical changes in tryptophan, 17: 6163
PARIKH, P., Nuclear polarization in very low magnetic fields, 17: 7126 (NP-12330(p.259-76))
PARIKH, Vastupal, High-energy photoprotons from C, 17: 7202
PARK, John J., Metallic reactions in U recovery, 17: 6184 (NBS-7582)
PARKER, A. W., Proton-capture γ rays from N-13, 17: 7153
PARKER, R. P., Gamma spectrometry and measurement of biological samples, 17: 5733
PARKINSON, W. C., University of Michigan 83-inch cyclotron. I., 17: 7364
PARKINSON, W. C., University of Michigan 83-inch cyclotron. III., 17: 7366
PARKINSON, W. C., University of Michigan 83-inch cyclotron. IV., 17: 7367
PARNELL, Furniss L., Civil defense in the food industry. I., 17: 6339
PARSHIN, I. M., Dosimeter for x- and γ radiation, 17: 6471
PARSONS, Donald F., Radiation damage in the mouse oocyte, 17: 5835
PARSONS, J. R., Neutron damage in Ge, 17: 6757
PARSONS, Thomas C., Close-capture adsorption system for radioisotope chemistry, 17: 5942 (UCRL-9659)
PARZEN, G., Computer program for orbit stability in circular accelerators, 17: 7345 (TID-15535)
PASECHNIK, M. V., Polarization of protons in stripping reactions, 17: 7286
PASTERNAK, Joseph, Status rpt. on thermoelectricity, 17: 6522 (NRL-Memo-1361)
PASTERNAK, M., Lifetimes of M1 transitions in La-137 and Kr-83, 17: 7256
PATASHINSKII, A. Z., Integral representations in perturbation theory, 17: 7515
PATEL, Rajni, Preparation and properties of kryptonates, 17: 6364 (NYO-9720)
PATHRIA, R. K., Quantum mechanics of many-body system, 17: 7511
PATRONIS, E. T., Jr., Beta-γ directional correlations in Re-186 and Tm-170, 17: 7218
PATTEN, C. G., Spiral ridge cyclotron at Univ. of California, Davis, 17: 7370
PATTERSON, G. N., Mechanics of rarefied gases and plasmas, 17: 7434 (UTIA-REV-18)
PATTERSON, R. L., Jr., Intercalibration of systems in monitoring fission products, 17: 5753 (NRL-5850)
PATTERSON, T. N. L., Capture of small particles by solar radiation field, 17: 6914
PAULIKAS, George A., Electron detachment from neutral H, 17: 6880
PAULY, Helmut, X-ray inactivation of lysine decarboxylase, 17: 5829
PAVANATI, G., Relativistic cyclotron, 17: 7361
PAVLOV, S. I., Mass spectrometer with parabolic potential, 17: 6416
PAWLIK, Eugene V., Beam neutralization tests of flight model electron bombardment engine, 17: 7646
PEARSON, C. A., Deuterons from high-energy proton bombardment, 17: 7258
PEARSON, C. E., Computer program for thin-shell problem, 17: 6507
PEARSON, G., Filter and assay unit for airborne radioiodine isotopes, 17: 5754 (PG-Report-408)
PEARSON, J. A., Thermal resistance of joint between fuel and canning material, 17: 6237
PEARSON, R. L., Prog. rpt. on hydrazine process development, 8–10/62, 17: 6123 (AGN-AN-756)
PEASLEE, D. C., Nuclear E1 peak splitting, 17: 7253
PEDRETTI, A., Organic reactor program, 17: 7618
PEEK, N. F., Spiral ridge cyclotron at Univ. of California, Davis, 17: 7370
PEHL, Richard H., Semiconductor transmission-counter system, 17: 6440 (UCRL-10030)
PEIERLS, Ronald F., Overlapping final-state interactions, 17: 6994
PEKAREK, L., Striations in h-f discharge, 17: 7444
PEKHTASHEV, I. (E.) S., Solubility of inorganic salts in organic solvents, 17: 6190 (AEC-tr-5574)
PELEKHOV, V. I., Gamma and internal conversion spectra in Gd isotopes, 17: 7175
PELETMINSKII, S. V., Effect of radiation processes on transport phenomena in plasma, 17: 7488
PELLAM, John R., Second sound absorption in rotating He, 17: 6871
PEMENT, F. W., Alpha-β transitions in H-Pd, 17: 6690 (WAPD-T-1268)
PEMSLER, J. P., Oxygen gradients in corroding Zr alloys, 17: 6579
PEMSLER, J. P., Prog. rpt. on Be corrosion, 7/62–9/62, 17: 6568 (NMI-1905)
PEN'KOVSKII, V. V., Radiation effects on metals, 17: 6768
PEPPARD, D. F., Extraction of Th(IV) as mixed complex, nitrate of chloride, 17: 6189 (TID-15313)
PEPPARD, D. F., Synergistic effects in extraction of selected metallic cations, 17: 6188 (TID-15271)
PERFILOV, N. A., Nuclear structure in high-energy reactions with nuclei, 17: 7186
PERKINS, Frank C., Prog. rpt. on oxidation of beryllides, 6/–9/62, 17: 6564 (DRI-2056)
PERKINS, Frank C., Prog. rpt. on oxidation of beryllides, 9–12/62, 17: 6653 (DRI-2071)
PERKINS, Harold J., Gas-flow counting of C-14 compounds, 17: 6470
PERKINS, Richard W., Removal of radioisotopes from Columbia River, 17: 6310 (HW-SA-2411)
PERNEGR, J., Description of cosmic-ray jet, 17: 6919
PERNER, D., Reaction of white P with CCl_4 under influence of radiation, 17: 6167
PEROV, A. A., Dissociation of D_3^+ ions in collisions with D_2 molecules, 17: 6896
PERRY, Ervin S., Shock mitigation with vermiculite concrete, 17: 5668 (DASA-1263)
PERRY, R., Cryogenic linacs, 17: 7327 (BNL-6511(p.206-8))
PERRY, R., Ion source developments, 17: 7340 (BNL-6511(p.323-34))
PERRY, R., ZGS injector, 17: 7310 (BNL-6511(p.7-18))
PERRY, R., ZGS injector vacuum system, 17: 7339 (BNL-6511(p.318-22))
PERRY, Ronald B., Research reactor fuel assay, 17: 6473
PERSON, Stanley, Effects of H^3-thymidine on bacteria, 17: 5793
PERULLI, Mario, Instability and damping in beam-plasma system, 17: 7441
PERYAM, David B., Freeze-dehydrated irradiated pork, 17: 6365
PETELENZ, Tadeusz, Experimental radiation disease in rabbits, 17: 5912
PETER, M., Ultra-high-field superconductivity, 17: 6873
PETERS, Brian F. G., Determination of P in Al–Si alloys, 17: 5994
PETERS, Ralph, Electrostatic deflector for Berkeley cyclotron, 17: 7405
PETERSEN, Donald F., Growth of cells exposed to internal beta irradiation, 17: 5773 (TID-13613)
PETERSEN, E. L., Characteristics of UCLA cyclotron r-f system, 17: 7377
PETERSON, D. T., Application of wax laps to vibratory polishers,

17: 6516 (IS-439)
PETERSON, David T., Pure metals from chemical processes, 17: 6515 (IS-394)
PETERSON, Robert W., Direct comparison of B-12 and N-12 β spectra, 17: 7141 (TID-15182)
PETERSON, T. J., Jr., Photoelectric K-absorption cross section of Be, 17: 6870
PETIT, J., Determining traces of impurities in Be, 17: 6027
PETRASHKU, M. G., Decay of mesic atoms of transition metals, 17: 6888
PETRENKO, L. I., Radioisotopes and radiation in economy of USSR, 17: 6369
PETROV, V. S., Features of x-ray induced early injuries, 17: 5888
PETROVA, N. A., Radioisotopes and radiation in economy of USSR, 17: 6369
PETRUKHIN, V. I., Absorption of π^- mesons in hydrogenous substances, 17: 7083 (JINR-P-1081)
PETRUNKIN, V. A., Scattering of neutrons by Coulomb field, 17: 7074
PETSCHEK, A. G., Reference spectrum method for nuclear matter, 17: 7214
PETSCHEK, H. E., MHD-supported hypersonic shock layer, 17: 6783 (BSD-TDR-62-337)
PETZOW, G., Cadmium tantalate as control material, 17: 6714
PETZOW, Guenter, Quasibinary system UFe_2–UAl_2, 17: 6727
PETZOW, Guenter, Structure and properties of U–V–Mo, 17: 6725
PEUCH, M. A., Balance for measuring magnetic susceptibilities at high or low temperatures, 17: 6385 (CEA-2187)
PFEIFFER, W., Plastic characteristics of Ni–Co crystals, 17: 6695 (AEC-tr-5568)
PFOTZER, G., Geomagnetic storm sudden commencement, 17: 6928
PICKART, Stanley J., Spin density distributions and Hartree-Fock calculations for Fe group series, 17: 6646 (BNL-5674)
PICKLESIMER, M. L., Intermediate phases in the Nb–Sn system, 17: 6703
PICKUP, Eric, Bubble chamber track-centering device, 17: 6464
PIEPER, G. F., Solar protons and magnetic storms, July 1961, 17: 6920
PIERANTONI, F., POLLY—one group Fermi age, 17: 6495 (CNEN-140)
PIERQUIN, B., Yttrium-90 needles in interstitial β therapy, 17: 5695
PIEZ, Karl A., Continuous scintillation counting of C-14, 17: 5709
PIK-PICHAK, G. A., Equilibrium figures and fission of rotating nucleus, 17: 7298
PINSON, W. H., Model of continent formation, 17: 6291
PISARENKO, N. F., Cosmic ray equator from satellite data, 17: 6938
PISARENKO, N. F., Inner radiation belt at 320 km in South Atlantic magnetic anomaly, 17: 6937
PISARENKO, N. F., Outer radiation belt on earth at 320 km, 17: 6936
PISAREVSKII, A. N., Scintillation method in radiometry, 17: 6444 (AEC-tr-5259)
PIXLEY, R. E., Excited state lifetime measurements, 17: 6450
PLANO, R., Decays of the ω and η mesons, 17: 6998
PLANO, R., Pion resonances in π^+-p interactions, 17: 6997
PLASER, J. P., Cyclotron for protons of 450 Mev, 17: 7394
PLATE, Patricia B., Defense Metals Information Center Accessions, 10/62, 17: 6518 (NP-12288)
PLATE, Patricia B., Defense Metals Information Center Accessions, 11/62, 17: 6521 (NP-12417)
PLOKHOI, V. I., Oxygen effect during irradiation of *E. coli*, 17: 5878
PLOTNIKOV, A. F., Radiation defects in Si, 17: 6767
PLUMLEE, K. E., Automatic foil activity counting facility, 17: 6494 (ANL-6628)
PLUNKETT, S., Characteristics of UCLA cyclotron r-f system, 17: 7377
PODGORETSKII, M. I., Interference phenomena in $K^0\bar{K}^0$ systems, 17: 7026
PODGORETSKII, M. I., Statistical behavior of linear systems, 17: 6891
POETZSCHKE, Manfred, Structure of T^+–B^3 systems. II., 17: 6729
POHL, R. O., Phonon-defect resonance interaction, 17: 6800 (TID-15495)
POIRIER, Yves, Putting electroconductive liquid in turbulence, 17: 7442
POLAK, L. S., Shifts of γ transition of Sn-119 in organo-tin compounds, 17: 7281
POLIKARPOV, V. I., Monitoring fuel element integrity, 17: 7583
POLK, I. J., Drift tube alignment on AGS linac injector, 17: 7343 (BNL-6511(p.381-5))
POLLAK, H., Mosaic structure and its determination, 17: 6644 (BLG-132)
POLLARD, J., Decay of Eu-152, 17: 7203
POLLERMANN, M., Research reactors in Western Europe, 17: 7640
POLLOCK, Warren I., Niobium physical metallurgy, 17: 6555
POLUEKTOV, N. S., Determination of rare earths in EOTA complexes, 17: 6010
POMERANCHUK, I. Ya., Amplitude attenuation for various processes, 17: 6894
POMERANCHUK, I. Ya., Regge poles and Landau singularities, 17: 7526
POMERAT, C. M., Human and monkey leukocytes in culture, 17: 5676 (SAM-TDR-62-99)
PONCE DE LEON, J. Montes, Neutron flux, 17: 7063
PONTECORVO, B., Low probability of μ decay processes, 17: 7032
POPOV, N. P., Analytical chemistry of rare elements, 17: 6024
POPOV, V. S., Feynman amplitudes for nonrelativistic processes, 17: 7524
POPPE, C. H., Fast neutron time-of-flight spectrometer, 17: 6465
POPPE, C. H., Neutrons from D + T and D + H, 17: 7241
PORILE, N. T., Product yields in Cu spallation by protons, 17: 7233
PORSCHEN, W., Critical masses for core arrangements in FRJ-1 Merlin, 17: 7559 (JÜL-76-RE)
PORSCHEN, W., Neutron flux measurements in FRJ-1 Merlin, 17: 7634 (JÜL-75-RE)
PORTEOUS, Lewis G., Cost analysis for fallout shelters, 17: 6324 (USNRDL-TR-582)
PORTER, N. A., Detection of μ mesons by human eye, 17: 6932
POSKANZER, A. M., Range of 1-3 Mev Ne-22 ions in Al and Na-24 recoil data, 17: 7231
POSKANZER, A. M., Recoil study of $Al^{27}(p,3pn)Na^{24}$, 17: 7230
POST, M. A., Growth of α Al_2O_3 · H_2O corrosion products on Al, 17: 6573 (TID-15280)
POTENZA, G., Nuclear fission induced by 600-Mev protons, 17: 7086 (NP-12319)
POWELL, J. E., Rare earth lactates, 17: 6039 (IS-445)
POWELL, James R., Flux flattening by variation of resonance escape probability, 17: 7533 (BNL-5412)
POWELL, W. B., Operation of 40-inch cyclotron, 17: 7354
POWERS, E. L., Effect of x rays on fission rate of Paramecium, 17: 5778 (TID-15521)
POYEN, Jacques, Inelastic charge exchange of K^+ mesons, 17: 6966
POZHORSKII (POJARSKII), B. G., Formation of plutonyl complexes in HNO_3, 17: 6191 (CEA-tr-R-1514)
PRACHT, D. W., Swelling of U on postirradiation annealing, 17: 6737 (ANL-6532)
PRASK, H. J., Lifetimes of 246- and 46.7-kev transitions in Po-210, 17: 7245
PRATHER, James G., Thermoelectric power of thin metallic films, 17: 6700 (UCRL-Trans-892(L))
PRATT, R. H., Spectrum of electron and positron bremsstrahlung, 17: 6983
PRECHT, W., Stabilized and hydration-resistant Eu_2O_3, 17: 6664 (MND-M-2346)
PREISENDANZ, Hans, Phase interfacial processes in Zr–N alloys, 17: 6724
PREISLER, E., Cadmium tantalate as control material, 17: 6714
PREISS, I. L., Neutron-deficient Ba isotopes, 17: 7194
PREMACHANDRA, B. N., Effect of mild hyperthyroidism upon secretion of I-131 in milk, 17: 5721
PRESTON, R. S., Nuclear resonance absorption of γ rays, 17: 6778 (ANL-6603(p.20-46))
PRICE, D. C., Turnover of Fe and vitamin B_{12}, 17: 5746
PRIGOGINE, I., Non-equilibrium thermodynamics, 17: 6107
PRIVOROTSKII, I. A., Absorption of ultrasound in superconductors, 17: 6890
PROKOSHKIN, Yu. D., Absorption of π^- mesons in hydrogenous substances, 17: 7083 (JINR-P-1081)
PROPST, F. M., Energy distribution of electrons ejected from W by He^+, 17: 6853
PROTOPOPOV, A. N., Angular anisotropy of γ quanta accompanying U-235 fission, 17: 7293
PROTOPOPOV, Kh. V., Scintillation method in radiometry, 17: 6444 (AEC-tr-5259)
PRUZANSKY, Jacob, Formation of hydrazine from radiolysis of ammonia, 17: 6125 (BNL-6016)
PUECHL, Karl H., Prog. rpt. on Pu fuels, 10/62, 17: 6523 (NUMEC-P-51)
PUGACHEVICH, P. P., Surface tension of liquid metals, 17: 6708
Puk, Ming Nam
see Ming, Nam Puk
PUNHANI, Sudarshan L., Scattering of EM radiation by free electrons,

17: 7114 (NP-12330(p.172-8))
PURCHAS, J. G., Welding of Zr and Zr alloys, 17: 6630
PUSCH, W. M., Inhaled doses following reactor accidents, 17: 6327
PYLE, Robert V., Electron detachment from neutral H, 17: 6880

Q

QVIST, J., Rotating rig for dosimeter calibration, 17: 6475

R

RAAB, Wolfgang P., Absorption of x rays in psoriatic horny layers, 17: 5689
RAAEN, Helen P., Polarography in hydrofluoric acid, 17: 5987
RABANI, Joseph, Reactivity of OH radicals in irradiated solutions, 17: 6165
RABINOWITZ, M., Vacuum calorimetry in exploding wire studies, 17: 6425
RABURN, W. D., Electronic shaping, 17: 6598 (SCTM-39-62(25))
RADAK, B., Reactor radiation dosimetry, 17: 6452
RADELOFF, J., Rotation levels of Er-168, 17: 7270
RADOSZEWSKI, T., Measurement of β radioactivity by 4π counting, 17: 6459
RAETHER, H., Investigation of electron avalanche with image intensifier, 17: 7018
RAFAELOFF, R., Separation of metals by focusing ion exchange, 17: 6180 (IA-769)
RAFAELOFF, R., Separation of precipitates using adhesion on glass, 17: 5952 (IA-772)
RAFTER, T. A., Radiocarbon age measurements. V., 17: 6295
RAGONE, David A., Thermodynamic measurements using optical absorption in metal vapors, 17: 6802 (TID-17348)
RAI, K. R., Widening Bragg peak in path of charged heavy particles in tissue, 17: 5766 (BNL-5538)
RAINEY, R. H., Aqueous processing of Th fuels. II., 17: 6186 (ORNL-TM-420)
RAJARAMAN, R., Three-nucleon clusters in nuclear matter, 17: 7215
RAKHOVSKII, V. I., Mass spectrometer with parabolic potential, 17: 6416
RAMACHANDRAN, G., Charged pions from nuclei, 17: 6975
RAMAGE, R. V., Internal high-pressure instrumentation problems, 17: 6408 (UCRL-6531)
RAMAIAH, A., Effect of x radiation on hepatic synthesis of fatty acids, 17: 5792
RAMANNA, R., Angular correlations of fission fragments in U-235, 17: 7098 (NP-12330(p.79-85))
RAMANNA, R., Emission of α particles in fission process, 17: 7097 (NP-12330(p.71-8))
RAMAZASHVILI, R. R., Temperature equalization of charged particles in plasma, 17: 7481
RAMSDEN, F., Trolley for radioactivity measuring equipment, 17: 6213
RAMSDEN, P., Magnetohydrodynamic power generation, 17: 6849
RAND, J. L., Telemetering installation to report Columbia River data by radio, 17: 6394 (HW-SA-2481)
RAND, M. H., Thermodynamics for U compounds, 17: 6106
RANE, A. T., Separation of Eu-156 and Gd-146,149 by ion exchange, 17: 7125 (NP-12330(p.253-7))
RANYUK, Yu. N., Reactions of total decay of nuclei, 17: 7282
RAO, I. Madhav, Inelastic scattering of cold neutrons in BeO, 17: 7130 (NP-12330(p.384-91))
RAO, J. Rama, Pair cross section of γ radiation, 17: 7116 (NP-12330 (p.186-92))
RAO, K. Anneji, Annealing radiation damage of (n,γ) reaction, 17: 7135 (NP-12330(p.422-8))
RAO, P. N. Rama, Angular correlations of fission fragments in U-235, 17: 7098 (NP-12330(p.79-85))
RAO, V. Surya, Corrosion and deposition on fuel rod cladding, 17: 6587
RAPOPORT, A., Excretion of Cs-137 in humans, 17: 5713
RAPOPORT, I. D., Antimatter in cosmic rays and outer space, 17: 6915
RAPOPORT, L. P., Pair correlations in nuclei, 17: 7190
RAPPE, Edwin F., Bubble chamber track-centering device, 17: 6464
RAPPERPORT, E. J., Prog. rpt. on refractory metals phase diagrams, 7/62–9/62, 17: 6668 (NMI-9246)
RASKOVIC, D., Granulocytes after irradiation and in leukemias, 17: 5811
RAUH, E. G., Thermodynamic properties of carbides, 17: 6052 (TID-17413)
RAUSCH, John J., Prog. rpt. on coatings for V-base alloys, 9/15/62–11/12/62, 17: 6562 (ARF-B6001-1)
RAUSCH, Ludwig, Radiobiological investigation of sieve irradiation. IV., 17: 5898
RAUTIAN, S. G., Theory of quantum generators, 17: 7523
RAY, Sylvian R., Description of transfer memory, 17: 6498 (NP-12307)
RAZGON, D. R., Radiation synthesis of ion-exchange sorbents, 17: 6140
RAZUMOVSKII, N. O., Complexons for accelerating elimination of Ce-144, 17: 5739
READ, P. A., Computer-aided analysis of γ spectrometer data, 17: 6442 (USNRDL-TR-592)
READ, R., Computations for fallout, 17: 5749 (CDRP-182-113)
READ, R. R., Estimating fallout by regression methods, 17: 6306 (CDRP-182-105)
READ, R. R., Winds aloft for selected seasons, 17: 6251 (CDRP-182-109)
READER, Paul D., Electron-bombardment ion rocket, 17: 7644 (NASA-TN-D-1457)
REDFIELD, J. A., Nuclear-thermal iteration analysis, 17: 7574 (WAPD-T-1225)
REDMOND, A. H., Standardization of Hurst Radsan neutron detector, 17: 6443 (USNRDL-TR-598)
REECE, B. L., Operation of 40-inch cyclotron, 17: 7354
REICH, C. W., 1.56-Mev state in Mo-94, 17: 7257
REICH, Haskell A., Nuclear magnetic resonance in solid He-3, 17: 6868
REICHEL, A., Calculation of effective resonance integrals, 17: 7054 (AEEW-R-118)
REIF, F., Energy gap in superconductors, 17: 6878
REIFENSCHWEILER, O., Sealed-off neutron tube, 17: 7069
REIMANN, George A., Vacuum-arc melting of W alloy, 17: 6592 (ASD-TDR-62-781)
REIN, James E., Photometric determination of B, 17: 5998
REINER, A. S., Density propagator for self-bound Fermion system. I., 17: 6989
REINIG, W. C., Control of T health hazards, 17: 6309 (DPSPU-62-30-5)
REISENAUER, A. E., Measurement of permeability in heterogeneous media. III., 17: 6790 (HW-SA-2405)
REISENAUER, A. E., Multidimensional partially saturated flow in soils, 17: 6256 (HW-SA-2854)
REITAN, Arne, K-shell photoelectric effect, 17: 6851
REIZENSTEIN, P. G., Turnover of Fe and vitamin B_{12}, 17: 5746
REMAEV, V. V., Decay of millisecond isomers, 17: 7294
REMSBERG, L. P., Product yields in Cu spallation by protons, 17: 7233
REMSKII-KORSAKOV, A. A., Photoelectron angular distribution, 17: 6833
RESMINI, F., Relativistic cyclotron, 17: 7361
REVIS, V. A., Treatment of radiation sickness by spleen homotransplantation, 17: 5926
REYNOLDS, Harry L., Materials for nuclear ramjets, 17: 6546
REYSS-BRION, Maryse, Radiation effects on competence of ectoderm, 17: 5807
REZANOV, I. I., Effect of natural radioactivity on population's health, 17: 6341
REZONTOV, V. A., Effect of thyreoidine after acute radiation sickness, 17: 5885
RHODE, J. I., Positron decay of Y-88, 17: 7254
RHODES, D. N., Treatment of meats with radiations. X., 17: 6367
RICE, Philip A., Thermodynamic measurements using optical absorption in metal vapors, 17: 6802 (TID-17348)
RICH, Theodore Alfred, Condensation nuclei detector, 17: 6488
RICHARDS, Albert G., Pinhole camera for radiation research, 17: 5688
RICHARDS, Albert G., Shielding for dental installations, 17: 6344
RICHARDSON, E. G., Jr., Measurement of ORIC magnetic field, 17: 7375
RICHARDSON, J. Reginald, Considerations on meson cyclotrons, 17: 7398
RICHARDSON, J. Reginald, Design of U.C.L.A. cyclotron, 17: 7353
RICHARDSON, J. Reginald, Spill beam from 88-inch cyclotron, 17: 7356
RICHARDSON, John M., New formalism in perturbation theory, 17: 6508
RICHARDSON, K. A., Conway granite of New Hampshire, 17: 6297
RICHEY, Frances, Collision cross sections and atomic scattering,

17: 6774 (AFCRL-531(I))
RICHTER, Herbert, Corrosion-resistant Zr alloys, 17: 6581
RICKARD, W. H., Phytosociological analyses following atomic explosions, 17: 5655 (HW-SA-2546)
RICKARD, W. H., Jr., Cesium-137 in dried milk products, 17: 5752 (HW-SA-2337)
RICKEY, M. E., Hydrogen ions in Univ. of Colorado cyclotron, 17: 7359
RICKEY, M. E., University of Colorado 52-inch cyclotron, 17: 7358
RICKEY, Martin E., Field design for Univ. of Colorado cyclotron, 17: 7372
RIEMERSMA, H., Operation of superconducting solenoid, 17: 6756
RIES, Herman E., Jr., Adsorption of radiolabeled compounds, 17: 6078
RIESE, Wolfram A., Resistivity of coating systems to energetic radiation, 17: 6704
RINZIVILLO, R., Nuclear fission induced by 600-Mev protons, 17: 7086 (NP-12319)
RIPPERGER, E. A., Application of external energy absorbers to large fission product shipping casks, 17: 6362
RIPPERGER, E. A., Shock mitigation with verniculite concrete, 17: 5668 (DASA-1263)
RISPOLI, B., Neutron thermopiles for flux measurement in reactors, 17: 6485
RISPOLI, Brunello, Neutron flux detectors, 17: 6447
RIVERA, Joseph, Prog. rpt. on fallout, 9–12/62, 17: 5751 (HASL-132)
ROAKE, W. E., Movement of fission fragments and Pu in UO_2 irradiation tests, 17: 6742 (HW-SA-2309)
ROBALEWSKI, Andrzej, Intrinsic viscosity of acrylamides polymerized in solid state, 17: 6129 (PAN-308/XVII)
ROBERTS, Audrey N., Quantitation of tritiated antigens, 17: 5724
ROBERTS, Louis D., Mössbauer-type study of Au-197, 17: 7234
ROBERTS, W. J., Temperature coefficients in SNAP reactors, 17: 7560 (NAA-SR-7140)
ROBINSON, B. B., Transport coefficients in fully ionized plasma, 17: 7455
ROBINSON, C. S., Determination of ρ,γ,π coupling constant, 17: 7001
ROBINSON, G. W., Electronic energy relaxation in the solids, 17: 6075
ROBINSON, Mark T., Ion ranges in solids, 17: 6820
ROCHE, Roland, Assembling together two pieces having anisotropic expansions, 17: 6632
ROCHER, Yves-Andre, Electronic structure of rare earth metals, 17: 6701
ROCHKIND, Mark M., Isotope effect in recombination of I atoms, 17: 6041 (LAMS-2781)
ROCKMORE, Ronald M., Reduction formalism for potential scattering, 17: 7506
ROCKMORE, Ronald M., Sampson-Seitz procedures and static responses of normal fermion systems, 17: 6992
ROCKWELL, C. D., Broaching steel and heat-resistant alloys, 17: 6622
RODENBERG, Rudolf, Cross section for EO transitions in electron and positron scattering, 17: 7269
RODENBERG, Rudolf, Two-photon exchange in electron-proton scattering, 17: 7017
RODRIGUEZ, T. Betancos, Extraction of U from solutions of uranyl carbonate, 17: 6198
ROGERS, E. J., Energy modulation of Van de Graaff accelerator, 17: 7307 (BNL-5792)
ROGERS, Frederick John, Fuel element charging and discharging arrangements, 17: 7590
ROGERS, J. J. W., Conway granite of New Hampshire, 17: 6297
ROHRBACK, G. H., Biochemical fuel cell potentialities for space flight, 17: 5663
ROMANOVSKII, E. A., Proton scattering on Ni and Cu, 17: 7178
ROMANOWSKI, T. A., Elastic scattering of π^- by protons at 152 and 226 Mev, 17: 6977
ROMER, Hermann, Improvements in reactors, 17: 7588
RONAYNE, Michael R., Electron attachment and solvation in irradiated glasses, 17: 6148
ROSENBAUM, Joe B., Liquid waste disposal in U milling, 17: 7650 (BM-RI-6114)
ROSENBERG, Leonard, Dispersion-theoretic impulse approximation for potential scattering, 17: 7512
ROSENTHAL, Marcia W., Effects of therapeutic removal of Pu, 17: 5706 (TID-14893)
ROSENZWEIG, M. L., Prog. rpt. on propulsion research, 7–12/61, 17: 7538 (DCAS-TDR-62-44)
ROSS, Bernd, Solar energy converters, 17: 6552
ROSS, D. B., Absorption of Mg-28 in sheep, 17: 5737
ROSS, H. H., Alpha gage for measurement of small density thicknesses, 17: 6422
ROSSEL, J., Distorted wave Born approximation calculations, 17: 7170
ROSSEL, J., Measurement of 1st excited level of Na-21, 17: 7171
ROSTAS, F., Electronic thermal conductivity in magnetoplasmas, 17: 7468
ROTENBERG, A. D., Whole-body scanning in medicine. I., 17: 5684
ROTENBERG, A. D., Whole body scanning in medicine. II., 17: 5806
ROTH, H. P., Proceedings of metallographic meeting, 17: 6524 (TID-7625)
ROTHENBACHER, Rolf, Oxidation of U, 17: 6582
ROUGH, Frank A., Fission-product-release measurement from clad fuel, 17: 6645 (BMI-1604)
ROUSSEL, J., Order parameter in β brass, 17: 6705
ROUSSET, P., Prog. rpt. on forming and irradiation of UC, 1–3/62, 17: 6533 (EURAEC-325)
ROWLAND, F. S., Reactions of recoil T atoms with $C_5H_5PtCl_3$, 17: 6087
ROWLAND, T. C., Power cycling of high-power-density fuel specimens, 17: 6513 (GEAP-4069)
ROZARENOV, L. A., Charged particle intensity during space-ship flights, 17: 6935
ROZENTAL, I. L., Origin of cosmic muons and photons of high energy, 17: 6940
ROZHIN, E. N., Conversion electron coincidences in Lu^{177m} decay, 17: 7180
R-SHERSBY-HARVIE, R. B., Phase and radial motion in linacs, 17: 7321 (BNL-6511(p.162-70))
RUBIN, B., Irradiation-induced phase changes in ZrO_2–UO_2 fuels, 17: 6753 (WAPD-T-1402)
RUBIN, B. F., Irradiation behavior of ZrO_2–UO_2 fuels, 17: 6752 (WAPD-264)
RUBY, S. L., Lifetimes of M1 transitions in La-137 and Kr-83, 17: 7256
RUCKENSTEIN, E., Film boiling heat transfer from horizontal surface, 17: 6240
RUDAKOV, L. I., Capture and containment of plasma, 17: 7485
RUDAKOV, L. I., Stability of inhomogeneous plasma, 17: 7436 (NP-tr-928)
RUDDY, John M., Fabrication of metal work for radiation experimental cells, 17: 6204 (BNL-5850)
RUDDY, John M., Hot cell layout criteria, 17: 6203 (BNL-5820)
RUDNICK, A. A., Sinterable MgO powders and ceramics, 17: 6590 (ASD-TDR-62-700)
RUEBE, Werner, EEG after fractional irradiation of brain, 17: 5902
RUEL, M., Partial and total capture probabilities of μ^- by C-12, 17: 6986
RUKHADZE, A. A., Temperature equalization of charged particles in plasma, 17: 7481
RUNDO, J., Natural radioactivity in electronic components, 17: 6415
RUNNALLS, O. J. C., Plutonium fuel program in Canada, 17: 6512 (CRRM-1111)
RUSAKOV, S. V., Photoproduction of π^0 in H and D, 17: 7036
RUSANOV, A. K., Determination of rare earths in rocks, 17: 6008
RUSSELL, F. M., Concepts of an Mc^2 cyclotron, 17: 7396
RUSSELL, J. A., Afterglow ionization in hydromagnetic shock tube, 17: 7422 (AWRE-O-11/62)
RUSSELL, J. E., Note on the Born series, 17: 6973
RUSSELL, Philip W., Kill probability in target area family shelters, 17: 6345
RUSSELL, R. Scott, Radioactive materials in food chains, 17: 6336
RUSTGI, M. L., Photodisintegration of He, 17: 7238
RUTGERS, A. J., Ionic hydration, 17: 6096
RUTKEVICH, N. Yu., Reactions of total decay of nuclei, 17: 7282
RUZIN, V. A., Scintillation method in radiometry, 17: 6444 (AEC-tr-5259)
RYABCHIKOV, D. I., Chemistry of Sc and Y, 17: 6019
RYABCHIKOV, D. I., Chemistry of Th, 17: 6021
RYABUKHIN, V. A., Chemistry of Sc and Y, 17: 6019
RYAZANOV, G. V., Space-time approach to quantum field theory, 17: 7514
RYAZANOV, M. I., Emission in uniform charge motion, 17: 7038
RYBAK, Roman, Determination of Hf and Zr, 17: 6002
RYBAKOV, B. V., Scintillation method in radiometry, 17: 6444 (AEC-tr-5259)
RYTZ, A., Determination of resonance and threshold energies. II., 17: 7173

S

SAALFELD, F. E., Mass spectra of volatile hydrides, 17: 6791 (IS-424)
SACHER, G. A., Effect of x rays on fission rate of Paramecium, 17: 5778 (TID-15521)
SADAGOPAN, Varadachari, Strengthening mechanisms of dispersion-strengthened alloys, 17: 6591 (ASD-TDR-62-734)
SAEGUSA, K., Method of thyroid I-131 uptake, 17: 5743
SAGNELL, B., CERN 19-inch chassis systems, 17: 6388 (CERN-62-29)
SAGOT, M., Study of enriched fuel by means of pulsed neutron source, 17: 7535 (CEA-2201)
SAHAI, Baldev, Beta-γ circular polarization correlation in Eu-152, 17: 7107 (NP-12330(p.137-40))
SAILOR, V. L., Polarization of protons in Pd–Ni alloy, 17: 6945 (BNL-5648)
SAJI, Yoshio, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
SAKAMOTO, Yuichi, Hot plasma produced by linear discharge device, 17: 7449
SAKURAI, Tosio, Crystal structure of pentachlorophenol, 17: 6112 (AFOSR-2541)
SALAMON, M. B., Standardization of Hurst Radsan neutron detector, 17: 6443 (USNRDL-TR-598)
SALATSKII, V. I., Reaction $C^{13}(t,p)C^{14}$, 17: 7296
SALTER, Forrest, Ternary memory element using tunnel diode, 17: 6501 (TID-14155)
SALTYKOV, L. S., Polarization of protons in stripping reactions, 17: 7286
SAMSONOV, G. V., Preparation of Ce nitrides, 17: 6100
SAMUEL, David, Preparation of thin targets of isotopic O, 17: 5945
SANADA, J., Comparison of variable-energy synchrocyclotron and sector-focused cyclotron, 17: 7379
SANDENAW, Thomas A., Heat capacity of PuO, below 320°K, 17: 6049 (TID-15183)
SANDERSON, Ann R., Chromosomal aberration after diagnostic x irradiation, 17: 5846
SANDERSON, Colin G., Prog. rpt. on high-altitude sampling program, 12/1/62, 17: 6271 (NYO-10464)
SANDRU, P., Radioactive tracers in study of subterranean water flow, 17: 6377
SANDWEISS, J., Isobar pairs in β-p collisions, 17: 7002
SANIN, A. A., Electronic equipment in physics, 17: 6426
SARAF, Babulal, First forbidden β spectra of Nd-147, 17: 7113 (NP-12330(p.166-71)
SARDINA, M. T., Extraction of U from solutions of uranyl carbonate, 17: 6198
SARKAR, Madhuri, X-ray denaturation of DNA of *E. coli*, 17: 5855
SARMA, N., Alpha spectra using solid state detectors, 17: 7119 (NP-12330(p.202-8))
SARROUY, Jean-Louis, Gamma spectra and periods of Hf-170, 171 and Lu-170, 171, 17: 7162
SASAKAWA, Tetuya, Rotational motion in many-particle system, 17: 6956 (TID-13705)
SASAKI, Seibun, Yukawa type interactions between hyperons and mesons, 17: 7008
SASSI, E., Nuclear fission induced by 600-Mev protons, 17: 7086 (NP-12319)
SASTRY, B. Somalinga, Carbon-12 excited states, 17: 7102 (NP-12330 (p.104-8))
SASTRY, D. Lakshmana, Carbon-12 excited states, 17: 7102 (NP-12330 (p.104-8))
SATO, Masatomo, Radial density distribution in plasma column, 17: 7474
SATO, S., Prog. rpt. on properties of carbons and graphites, 8-9/62, 17: 6670 (NP-12350)
SATO, T., Electrolyte concentrations of intra- and extracellular compartments in internal diseases, 17: 5694
SATO, Taichi, Extraction of U(VI) from H_2SO_4 solutions, 17: 6196
SATSUNKEVICH, I. S., Scattering of electrons on protons, 17: 7050
SATYANARAYANA, K., Multiplication constants of BeO–U lattices, 17: 7131 (NP-12330(p.392-8))
SAUERMANN, P. F., Radiation protection by shielding, 17: 7499
SAUNDERS, Martin, Nature of slowly exchanging protons of RNA, 17: 6073
SAVENKO, I. A., Antimatter in cosmic rays and outer space, 17: 6915
SAVENKO, I. A., Cosmic ray equator from satellite data, 17: 6938
SAVENKO, I. A., Inner radiation belt at 320 km in South Atlantic magnetic anomaly, 17: 6937
SAVENKO, I. A., Outer radiation belt of earth at 320 km, 17: 6936
SAVIC, P., Expanding vapor bubble in boiling liquid, 17: 6235
SAVICH, A. V., Radiation-induced chemical changes in tryptophan, 17: 6163
SAVITSKII, P. S., Radioisotopes and radiation in economy of USSR, 17: 6369
SAVVIN, S. B., Complexing arsenazo III with elements, 17: 6007
SAYAR, K., Prestressed cylindrical concrete shields for reactor pressure vessels, 17: 7500
SAYEG, Joseph A., Godiva II critical assembly, 17: 5774 (TID-13984)
SAYENKO, L. F., Spin of Eu-152m, 17: 7287
SCATCHARD, George, Equilibrium H_2O content of ion exchange resins, 17: 5939 (TID-13384)
SCHADEK, Janos, Vacuum evaporator for preparing radioactive sources, 17: 6158
SCHAEFFER, Riley, Synthesis of a B labeled tetraborane, 17: 5944
SCHAFFER, O., Shielding calculations for Merlin reactor, 17: 7632 (JÜL-67-RE)
SCHEIFFARTH, F., Immunopathological problems of organ transplantation, 17: 5814
SCHELLENBERG, L., Decay of Ir-192, 17: 7172
SCHERMER, R., Polarization of protons in Pd–Ni alloy, 17: 6945 (BNL-5648)
SCHICK, H. L., Prog. rpt. on thermodynamics of refractory compounds, 9-11/62, 17: 6045 (RAD-SR-62-251)
SCHIFF, Daniel, Pyrolytic materials, 17: 6550
SCHILDER, Jaroslav, Deformation of traveling magnetic field, 17: 6811 (FTD-TT-62-981)
SCHIMA, F., Lifetimes of 246- and 46.7-kev transitions in Po-210, 17: 7245
SCHIMKAT, H., Stresses in steel plates clad with stainless steel, 17: 6586
SCHINDEWOLF, U., Hydrogen isotope exchange with aqueous suspensions of catalysts, 17: 6098
SCHINDLER, K., Controlled thermonuclear fusion experiments, 17: 7453
SCHINDLER, R. N., Photolysis and radiolysis of iodoethane, 17: 6130 (RRL-78T)
SCHLACKS, Henry P., Radiological safety at Hardtack, 17: 6317 (OTO-58-3)
SCHLEICHER, Hans-Walter, Corrosion-resistant Zr alloys, 17: 6581
SCHMAEHL, D., Tumor development in rats after x irradiation, 17: 5860
SCHMID, E., Gamma spectrometric studies on fallout, 17: 6346
SCHMIDT, J. J., Request for σ_{nf} (Pu 240) measurements, 17: 7077 (EANDC(E)-37L)
SCHMIDT-AMELUNG, K., Energy needs and atomic energy, 17: 5659
SCHNEIDER, H., Magnetoacoustic resonance in cylindrical plasma, 17: 7447
SCHNEIDER, H., Temperature determination by transmission time measurement, 17: 7446
SCHNITZEL, Randolph H., Physical metallurgy of W, 17: 6688 (WADD-TR-60-37(Pt.III))
SCHNITZER, H. J., Applications of pology to stripping reactions, 17: 7255
SCHOENFELD, I., Determination of Zn in U, 17: 6001
SCHROCK, V. E., Transport properties of air, 17: 6806 (UCRL-7052)
SCHUBERT, Konrad, Structure of T^x–B^y systems. II., 17: 6729
SCHUCH, A. F., Bond lengths in solid He, 17: 6046 (TID-13145)
SCHUCH, R. L., Arm counter in blood clearance studies, 17: 5677 (TID-14613)
SCHULL, W. J., Maternal radiation and mongolism, 17: 5848
SCHULT, Otto W. B., Neutron capture spectrum of Sm-150, 17: 7273
SCHULTZ, H., Determination of γ attenuation factors of shielding materials, 17: 7501
SCHULTZ, J., Decays of the ω and η mesons, 17: 6998
SCHULTZ, J., Pion resonances in π^+-p interactions, 17: 6997
SCHULTZ, N. B., Correlation of uranium α surface contamination and urinary excretion, 17: 5703 (TID-12729)
SCHULTZ, T. D., Theory of magnetothermomechanics, 17: 6859

SCHUMAN, R. P., 1.57-Mev state in Mo-94, 17: 7257
SCHUPP, G., Internal conversion coefficients in Sm-152 and Gd-152, 17: 7079 (IS-272)
SCHUPPLI, R., Biological action of x radiation, 17: 5813
SCHWARCZ, Ervin H., Shell model study of Mn-55, 17: 7240
SCHWARCZ, Ervin H., Shell model study of Mn-55, 17: 7145 (UCRL-6404)
SCHWARTZ, Emanuel E., Distribution and metabolism of MEG and GED, 17: 5908 (SAM-TDR-62-68)
SCHWARZ, H. P., Lipid composition of liver mitochondria from normal and irradiated rats, 17: 5772 (TID-13322)
SCHWARZSCHILD, A., Production of particles by 30-Bev protons on Al, Be, and Fe, 17: 7259
SCHWEE, L. J., Ferromagnetic resonance in garnets, 17: 6042 (NOL-TR-62-34)
SCHWEITZER, Donald G., Effect of graphite chemical reactivity on conditions in air-cooled channels, 17: 7534 (BNL-5891)
SCHWOCHAU, Klaus, Preparation and properties of cyano complexes of four- and five-valent Tc, 17: 6040 (JUL-68-RC)
SCIAMANNA, A. F., Radiolysis of liquid isobutane, 17: 6134 (UCRL-9924)
SCOTT, D. L., Modifications of cylindrical powder diffraction camera, 17: 6392 (GAT-T-973)
SCOTT, F. A., Electrolytic growth of UO_2, 17: 6514 (HW-74784)
SCOTT, F. A., Polarograph for controlled potential polarography, 17: 6393 (HW-SA-2300)
SCOTT, V. D., Electron microscope studies of Be, 17: 6641 (AWRE-O-59/62)
SCOTT, W. R., Biochemical fuel cell potentialities for space flight, 17: 5663
SEARCY, A. W., Thermodynamic functions for solids, 17: 6108
SEDLAK, C. D., Prog. rpt. on nuclear superheater, 7–9/62, 17: 7601 (GNEC-254)
SEEGER, A., Plastic characteristics of Ni–Co crystals, 17: 6695 (AEC-tr-5568)
SEETZEN, J., Prestressed cylindrical concrete shields for reactor pressure vessels, 17: 7500
SEGHEZZI, Hans-Dieter, Oxidation of U, 17: 6582
SEGHEZZI, Hans-Dieter, Rate of evaporation of Ta in vacuum, 17: 6726
SEGUIER, Jacques, Infrared emission spectrum of Cs, 17: 6843
SEIDEL, R. L., Determining source of nuclear system pipe wall radiation, 17: 6574 (TID-15281)
SEIDL, R., Influence of positive ions on exoelectron emission, 17: 6831
SEILER, F., Polarization of neutrons from (d,t) reaction, 17: 7066
SELECTOR, Yu. M., Multiple production of π mesons in πp collisions, 17: 7035
SELIG, H., Vapor pressure and transition points of TcF_6, 17: 6083
SELIVANOV, L. N., Handbook on toxicology of radioisotopes, 17: 5748
SELL, Heinz G., Physical metallurgy of W, 17: 6688 (WADD-TR-60-37 (Pt.III))
SELLEN, J. M., Jr., Beam neutralization tests of flight model electron bombardment engine, 17: 7646
SELLSCHOP, J. P. F., Nuclear resonant scattering of γ radiation, 17: 7229
SEMCHYSHEN, M., Arc-cast Mo- and W-base alloys, 17: 6672 (NP-12383)
SEMENOV, L. F., Streptomycin in prevention of radiation sickness, 17: 5911 (JPRS-16471)
SEN, A., Theory of angular momentum, 17: 7527
SEN, B., Neutron-α reaction in In, 17: 7207
SEN, B., Reactions (n,α) induced by 14-Mev neutrons, 17: 7094 (NP-12330 (p.46-52))
SEN, R. N., Theory of angular momentum, 17: 7527
SEPETOSKI, W. K., Computer program for thin-shell problem, 17: 6507
SERDYUK, N. K., Competing reactions involving radicals, 17: 6071
SERGIENKO, V. A., Conversion electron coincidences in Lu^{176m} decay, 17: 7180
SERIS, Jean-Louis, Protection of yeast cells against x radiation, 17: 5919
SEYLAZ, J., Measurement of 1st excited level of Na-21, 17: 7171
SHAKHOV, A. A., Effect of cosmic radiation on plant activity, 17: 5781 (FTD-TT-62-771)
SHALEK, P. D., Uranium monosulfide and ThS bodies, 17: 6636 (ANL-FGF-247)
SHAL'NOV, M. I., Radiolysis of orotic acid, 17: 5877
SHANKAR, J., Corrosion and deposition on fuel rod cladding, 17: 6587
SHANKAR, J., Isotopic exchange in Co(II)–Co(III) system in perchloric acid. II., 17: 6084
SHANKAR, Jodgish, Annealing radiation damage of (n,γ) reaction, 17: 7135 (NP-12330(p.422-8))
SHANKAR, Jogdish, Annealing radiation damage of (n,γ) and (γ,n) reactions, 17: 7134 (NP-12330(p.415-21))
SHANKAR, Jogdish, Plate theory applied to displacement chromatography, 17: 6004
SHANKER, J., Nuclear recoil following radiative capture of neutrons by Co-59, 17: 7133 (NP-12330(p.407-14))
SHANKS, H. R., Electrical properties of tungsten bronzes, 17: 6658 (IS-433)
SHANNON, D. W., Electrical properties of ZrO_2 corrosion films, 17: 6656 (HW-75501)
SHAPIRO, Bernard, Distribution and metabolism of MEG and GED, 17: 5908 (SAM-TDR-62-68)
SHAPIRO, I. M., Influence of radiation-induced chromosomic aberrations on viability of cancerous cells, 17: 5890
SHAPIRO, I. S., Expansion of scattering amplitude in spherical functions, 17: 7521
SHAPIRO, I. S., Radiative capture of μ^- mesons by protons, 17: 7047
SHARMA, R. P., Decay of Eu-156, 17: 7108 (NP-12330(p.141-6))
SHARMA, R. P., First forbidden β spectra of Nd-147, 17: 7113 (NP-12330 (p.166-71))
SHARP, A. A., Extracorporeal irradiation of the blood, 17: 5847
SHARP, W. E., Thermodynamic functions for H_2O, 17: 6055 (UCRL-7118)
SHAVRIN, P. I., Cosmic ray equator from satellite data, 17: 6938
SHAVRIN, P. I., Inner radiation belt at 320 km in South Atlantic magnetic anomaly, 17: 6937
SHAVRIN, P. I., Outer radiation belt of earth at 320 km, 17: 6936
SHAY, Harry, Irradiation and 3-methylcholanthrene administration in breast tumor, 17: 5839
SHCHEGLOVA, E. P., Determination of NH_4^+ and free acid in fluoberyllate, 17: 6017
SHEBANOV, V. A., Generation of π^0 mesons in Coulomb field of nucleus, 17: 7020
SHEBANOV, V. A., Resonance in $K^0\bar{K}^0$ pair production, 17: 7039
SHEEN, E. M., Radiation monitor and analyzer, 17: 6433 (HW-71354)
SHEER, R. E., Jr., Non-linear conductivity of plasma for MHD power generation, 17: 7491
SHEFNER, Deborah, Effect of x rays on fission rate of Paramecium, 17: 5778 (TID-15521)
SHEHATA, S., Inelastic diffraction scattering, 17: 7205
SHELIKE, P., Decay scheme of Eu-148, 17: 7181
SHELLABARGER, Claire J., Irradiation and 3-methylcholanthrene administration in breast tumor, 17: 5839
SHEPHERD, H. J., Treatment of meats with radiations. X., 17: 6367
SHEPPARD, C. W., Physical dosimetry in biological experiments with fast neutrons, 17: 6315 (ORNL-1559)
SHESKOLSKAYA, A. Ya., Determination of Zr in Mo and W, 17: 6012
SHEVCHENKO, O. P., Excitation of Be-8 in $Li^7(p,\alpha)He^4$, 17: 7179
SHEVCHENKO, V. G., Cross sections for photoproton reactions in Pb, 17: 7289
SHEVLIN, T. S., Final rpt. on thermoelectric materials, 1/1/60–9/30/61, 17: 6633 (AD-274831)
SHEWCHUCK, Sergey, Ray protection for firemen, 17: 6326 (UCRL-Trans-838(L))
SHIBATA, Kyoko, Influence on embryonal development of x irradiation, 17: 5897
SHIDEI, T., Efficiency in liquid scintillation counting, 17: 6454
SHIELD, Richard, Shock mitigation with vermiculite concrete, 17: 5668 (DASA-1263)
SHIRYAEV, B. M., Angular anisotropy of γ quanta accompanying U-235 fission, 17: 7293
SHKAROFSKY, I. P., Transport coefficients in fully ionized plasma, 17: 7455
SHKLAR, Gerald, Effects of 200 kv and Co-60 radiation on jaws and dental structure, 17: 5867
SHLYAPNIKOV, Yu. A., Diffusion coefficients in polymers, 17: 5943
SHPINEL, V. S., Shifts of γ transition of Sn-119 in organo-tin compounds, 17: 7281
SHUBINA, A. V., Effect of pharmacopoeial preparations on experimental

radiation sickness, 17: 5927
SHUBINA, R. V., Absolute polarization of magnetic nuclei, 17: 7267
SHUKLA, S. K., Solution chemistry of Pb-210, Bi-210, and Po-210. II., 17: 6153
SHULL, Harrison, Electron pairs in Be atom, 17: 6842
SHULYACHENKO, V. N., Multiple production of π mesons in np collisions, 17: 7035
SHUMWAY, Robert H., Strontium-90 levels in milk, 17: 6353
SHUTE, G. G., Proton-capture γ rays from N-13, 17: 7153
SIDLES, P. H., Electrical properties of tungsten bronzes, 17: 6658 (IS-433)
SIDOROV, B. N., Mechanism of genetic effect of radiation, 17: 5875
SIEGBAHN, K., Internal bremsstrahlung, 17: 7152
SIEGBAHN, Kai, Conference on sector-focused cyclotrons, 17: 7352
SIIVOLA, Antti, Alpha activity of Eu isotopes, 17: 7150
SILIN, I. N., Phase-shift analysis of nucleon-nucleon scattering, 17: 7027
SILIN, V. P., Relaxation of temperatures of plasma in strong magnetic field, 17: 7489
SILIN, V. P., Temperature equalization of charged particles in plasma, 17: 7481
SILVER, M., Properties of Zr–O, Ti–O, and Hf–O systems, 17: 6111
SIMKOVA, J., Reaction $Al^{27}(p,\alpha)Mg^{24}$, 17: 7168
SIMON, Helmut, Recrystallization of D-mannose-l-t phenylhydrazone, 17: 6118
SIMONEK, Jiri, Nuclear power station parameters, 17: 7619
SIMONOV, Yu. A., Four-fermion interaction by unitarity and analyticity, 17: 7042
SIMPSON, H., Short-lived radioactive isotopes in activation analysis, 17: 6029
SIMPSON, R. E., Neutron and γ dosimetry in animal exposure volume at TRIGA, 17: 5780 (USNRDL-TR-583)
SIMPSON, W. J. K., Whole body scanning in medicine. II., 17: 5806
SINCLAIR, C. K., Conference on linear accelerators, 8/62, 17: 7308 (BNL-6511)
SINGH, R. N., Kinetics of reaction between Pu(III) and Cl, 17: 6057 (AEC-tr-5552)
SINGH, Sarjeet, Recoil study of $C^{12}(p,pn)C^{11}$, 17: 7147 (UCRL-9911)
SINODOVA, E. P., Elastic properties of Al–Ti alloys, 17: 6709
SIROTKIN, I. A., Charged particle intensity during space-ship flights, 17: 6935
SIROVICH, Lawrence, Dispersion relations in rarefied gas dynamics, 17: 6238
SIZOV, I. V., Reaction $C^{12}(t,p)C^{14}$, 17: 7296
SKALA, George Frank, High expansion ratio condensation nuclei apparatus, 17: 6490
SKORYUPIN, V. A., Capture and containment of plasma, 17: 7485
SKOWRONEK, Maurice, Luminous phenomena accompanying ionized gas explosion, 17: 7443
SKRIVANKOVA, M., Reaction $Al^{27}(p,\alpha)Mg^{24}$, 17: 7168
SLAETIS, Hilding, Photographically recorded conversion lines. II., 17: 6823
SLAUGHTER, G. M., Joining of refractory metals, 17: 6558
SLIFKIN, Lawrence, Disintegrations produced by 1.55-Bev protons, 17: 7261
SMETANA, O., Frictional pyrophoricity of alloys, 17: 6693 (AEC-tr-5544)
SMIRENKIN, G. N., Kinetic energy of fragments in subbarrier fission, 17: 7300
SMIRNOV, A. M., Decay of millisecond isomers, 17: 7294
SMIRNOV, V. V., Photoelectron angular distribution, 17: 6833
SMIRNOV, Yu. F., Normalized α widths in α model, 17: 7189
SMIRNOVA, I. B., Effect of AET on radiation damage of mucous membrane, 17: 5891
SMITH, B. H., Berkeley 88-inch cyclotron r-f system, 17: 7378
SMITH, B. H., Oscillator and magnet power supplies, 17: 7412
SMITH, C. L., Radiation and health, 17: 5906
SMITH, C. W., Application of external energy absorbers to large fission product shipping casks, 17: 6362
SMITH, Darryl B., Reactions $He^3 + t$, 17: 7250
SMITH, George Donald, Radiation detector shielding, 17: 6486
SMITH, J. W., Sodium activation by fast neutrons in man phantoms, 17: 5736
SMITH, K. C., Circuits for pattern articulation unit, 17: 6506 (TID-17350)
SMITH, K. C., Operation of 3-bit bubbling register, 17: 6499 (NP-12308)
SMITH, L., Bevatron injector, 17: 7309 (BNL-6511(p.1-6))
SMITH, L., Electrostatic deflector for Berkeley cyclotron, 17: 7404
SMITH, L., Linac focusing, 17: 7333 (BNL-6511(p.274-82))
SMITH, L., Stepped phase velocity linacs, 17: 7329 (BNL-6511(p.224-34))
SMITH, L. H., Sensitivity of mouse bone-marrow cells x-irradiated *in vitro*, 17: 5831
SMITH, Lloyd, Comparison of accelerator types, 17: 7392
SMITH, M. C., Reflecting microscope for temperatures to above 2500°C, 17: 6406 (TID-13148)
SMITH, S. R., Effects of γ radiation on plant yields, 17: 5827
SMITH, W. G., Positron decay of Y-88, 17: 7254
SMITH, W. R., Features in Oak Ridge isochronous cyclotron, 17: 7357
SMITH, W. R., Measurement of ORIC magnetic field, 17: 7375
SMOLUCHOWSKI, R., Valences of Ce allotropes, 17: 6047 (TID-14535)
SMULDERS, P. J. M., Investigation of $^{26}Mg(\alpha,\gamma)^{30}Si$ reaction, 17: 7262
SMYTHE, Rodman, Hydrogen ions in Univ. of Colorado cyclotron, 17: 7359
SMYTHE, Rodman, Univ. of Colorado cyclotron dee design, 17: 7408
SMYTHE, Rodman, University of Colorado 52-inch cyclotron, 17: 7358
SNEDDON, Graham William, Nuclear steam generating plant, 17: 6225
SNIEGOSKI, L. T., Recrystallization of D-mannose-l-t phenylhydrazone, 17: 6118
SNITH, J. W., Intermediate-energy neutron spectra around nuclear installations, 17: 6482
SNYDER, H. J., Prog. rpt. on hydrazine process development, 8–10/62, 17: 6123 (AGN-AN-756)
SNYDER, Howard A., Attenuation of second sound in flowing He II, 17: 6881
SNYDER, M. J., Sinterable MgO powders and ceramics, 17: 6590 (ASD-TDR-62-700)
SNYDER, W. A., Prog. rpt. on reactor development, 4–6/62, 17: 7546 (HW-74761)
SOBOLAK, E. S., Photon asymmetry in bremsstrahlung of polarized electrons, 17: 6978
SODA, Toshio, Microscopic basis of macroscopic magnetostatic energy, 17: 6834
SODERSTROM, H. R., Fixture for grinding thin Rene 41 part, 17: 6626
SOLARI, P. A., Critical masses for core arrangements in FRJ-1 Merlin, 17: 7559 (JÜL-76-RE)
SOLOV'EV, A. S., Chemistry of Zr salts, 17: 6097
SOLOVEVA, Z. I., Ternary fission of U, 17: 7279
SOLOVIEVA, E. A., Analyzing peripheral blood in chronic action of radiations, 17: 5823
SOLYAKIN, G. E., Energy distributions of U-238 photofission fragments, 17: 7291
SOMANATHAN, C. W., Multiplication constants of BeO–U lattices, 17: 7131 (NP-12330(p.392-8))
SOMORJAI, Endre, Nuclear reactions in Li-6 by protons, 17: 7200
SOO, S. L., Electrification and removal of electrons by solid particles in gas, 17: 7467
SOOD, B. S., Interference between Rayleigh and resonance scattering, 17: 7109 (NP-12330(p.147-51))
SOOD, P. C., Coulomb energy calculations for light nuclei, 17: 7090 (NP-12330(p.17-21))
SOROKIN, Yu. I., Cross sections for photoproton reactions in Pb, 17: 7289
SOSNOVOSKY, H. C., Radiation effects on semiconductor catalysts, 17: 6738 (ASD-TDR-62-233)
SOUFFRIN, Suzanne, Non-Maxwellian distribution of electrons, 17: 6830
SOWBY, F. D., Radiological hazards to patients, 17: 6335
SPALDING, J. F., Comparative resistance of mice to low intensity γ irradiation, 17: 5777 (TID-15181)
SPECHTER, H.-J., Dosage during irradiation of uterine carcinoma, 17: 5819
SPEISER, R. C., Gas discharge Cs ion source, 17: 6900
SPENCE, R., Countercurrent liquid-liquid extraction, 17: 6178 (AERE-R-4091)
SPENCER, Neil C., Close-capture adsorption system for radioisotope chemistry, 17: 5942 (UCRL-9659)
SPIEGEL, V., Jr., Energy dependence of proportional counter neutron dosimeter, 17: 6477
STACKELBERG, M. v., Crystal structure of MeC, carbides, 17: 6692 (AEC-tr-5486)
STAFFORD, F. E., Heats of vaporization of solids. I., 17: 6095

STALLWOOD, R. A., Oxygen content of organic materials, 17: 5993
STAMER, P., Evidence for $K^+ \rightarrow \pi^+ + \pi^- + e + \nu$ decay mode, 17: 6999
STANDERFER, F. R., Prog. rpt. on hydrazine process development, 8–10/62, 17: 6123 (AGN-AN-756)
STANDING, K. G., University of Manitoba cyclotron, 17: 7368
STANKOVIC, V., Whole-body radiation effects on guinea pigs, 17: 5783
STARKE, E. A., Preferred orientation measurement in U, 17: 6681 (TID-17492)
STAROVOITOV, A. T., Effect of magnetic field on pulsed discharge in Ar, 17: 7486
STASHKOV, A. M., Recording of injuries in nervous system from irradiation, 17: 5886
STAUB, H. H., Determination of resonance and threshold energies. II., 17: 7173
STAUDER, R. F., Ferromagnetic resonance in garnets, 17: 6042 (NOL-TR-62-34)
STECHER, G., Polycythemia vera, 17: 5687
STEEB, Siegfried, Electron diffraction of UO, double layers, 17: 6728
STEEB, Siegfried, Quasibinary system UFe_2–UAl_2, 17: 6727
STEHLE, P., Photon asymmetry in bremsstrahlung of polarized electrons, 17: 6978
STEIGLEDER, Gerd K., Absorption of x rays in psoriatic horny layers, 17: 5689
STEIMEL, K., Cyclotron for protons of 450 Mev, 17: 7394
STEIN, Gabriel, Reactivity of OH radicals in irradiated solutions, 17: 6165
STEINBERG, Meyer, Formation of hydrazine from radiolysis of ammonia, 17: 6125 (BNL-6016)
STEINBERGER, J., Decays of the ω and η mesons, 17: 6998
STEINBERGER, J., Pion resonances in π^+-p interactions, 17: 6997
STEINER, Herbert M., Antiproton-nucleon cross sections, 17: 6959 (UCRL-9288(Rev.))
STEPANOV, A. S., Survival rate and sexual sterilization of granary weevil, 17: 6368
STEPANOVIC, S., Effect of x radiation and cysteamine on barbiturate response, 17: 5788
STEWART, J. R., Uranium exploration in South Alligator Area, 17: 6277
STEWART, John S. S., Chromosomal aberration after diagnostic x irradiation, 17: 5846
STIENNON-BOVY, R., Preparation of Te-132 and I-132, 17: 6172
STIJFHOORN, Dick, Mass spectrometric determinations of O-17 and O-18 in D_2O, 17: 5956 (KR-30)
STOCKDREHER, W., Nanosecond high-voltage pulses for internal cyclotron beam deflection, 17: 7344 (CERN-62-25)
STOENNER, R. W., Product yields in Cu spallation by protons, 17: 7233
STOKELY, J. R., Chemical separation for radiomanganese, 17: 6128 (ORNL-TM-438)
STOLETOV, G. D., Amplitudes of nucleon-nucleon scattering, 17: 7080 (JINR-P-1024)
STOLETOV, G. D., Elastic scattering of protons by carbon nuclei, 17: 7081 (JINR-P-1025)
STOLETOV, G. D., Triple scattering of 660-Mev protons. III., 17: 7041
STOLL, Basil A., Radiation sickness: controlled drug trials, 17: 5918
STONEHOUSE, A. J., Prog. rpt. on intermetallic compounds, 7–9/61, 17: 6643 (BBC-112)
STORM, M. R., Computer program for orbit stability in circular accelerators, 17: 7345 (TID-15535)
STRAIMER, G., Disposal of radioactive wastes, 17: 7654
STRANG, V. G., Comparative resistance of mice to low intensity γ irradiation, 17: 5777 (TID-15181)
STRAUB, C. P., Radioiodine in milk of cows, 17: 6356
STRAUSS, H. E., Prog. rpt. on properties of carbons and graphites, 8–9/62, 17: 6670 (NP-12350)
STREETON, R. J. W., Countercurrent liquid-liquid extraction, 17: 6178 (AERE-R-4091)
STRELKA, V., Influence of positive ions on exoelectron emission, 17: 6831
STRIEBEL, H. R., Polarization of neutrons from (d,t) reaction, 17: 7066
STRNAD, A. R., Currents in hard superconductors, 17: 6875
STRNAD, A. R., Magnetization and critical supercurrents, 17: 6865
STROMATT, R. W., Polarograph for controlled potential polarography, 17: 6393 (HW-SA-2300)
STROMBERG, Harold, Calibration of Bridgman anvils, 17: 6410 (UCRL-9807)
STRUDLER, P. M., Neutron-deficient Ba isotopes, 17: 7194
STRUXNESS, E. G., Prog. rpt. on waste treatment and disposal, 6–7/62, 17: 7653 (ORNL-TM-396)
STRZHIZHOVSKII, A. D., Radiation damage of cell populations, 17: 5876
STUART, Robert Stanley, Airborne radiation sampling electrostatic precipitator, 17: 6314 (NP-12386)
STUIVER, Minze, Natural radiocarbon measurements. VI., 17: 6298
STUIVER, Minze, Natural radiocarbon measurements. VII., 17: 6299
STURCKEN, E. F., Irradiation growth in U, 17: 6762
STURCKEN, E. F., Preferred orientation measurement in U, 17: 6681 (TID-17492)
STURCKEN, E. F., Thermal expansion coefficients for rolled U sheet, 17: 6682 (TID-17495)
STUTZ, E., Tumor development in rats after x irradiation, 17: 5860
SUAREZ, Cristina, Preparation of P-32, 17: 6141
SUBBOTIN, V. G., Determining proton emission by nuclei, 17: 7082 (JINR-P-1072)
SUBRAHMANYAM, P., Polarization of bremsstrahlung from 3.5-Mev electrons, 17: 7112 (NP-12330(p.162-5))
SUCCI, C., Relativistic cyclotron, 17: 7361
SUDAN, R. N., Plasma electromagnetic instabilities, 17: 7457
SUGANO, Reiji, Existence of new boson coupled with Λ and μ, 17: 7011
SUGAWARA, M., Behavior of elastic-scattering amplitudes, 17: 7003
SUK, M., Description of cosmic-ray jet, 17: 6919
SUKHANOV, A. D., Surface divergences in the Bogolyubov method, 17: 7516
SUKHAREVSKAYA, O. Yu., Ultrasonic splitting of Mössbauer line in $Sn^{119}O_2$, 17: 6889
SULLIVAN, James C., Identification of Np(V)–Cr(III) complex, 17: 6074
SUMNER, M. E., Isotopic exchange of K in illite, 17: 6102
SUNDERLAND, J. E., Effects of surface heat transfer on thermoelectric generator, 17: 6222
SUNDERLAND, R. J., Performance of crossed-field plasma accelerator, 17: 7647
SUNDERMAN, D. N., Short-lived isotopes in study of reactor fuel materials, 17: 7584
SURMONT, J., Total-body irradiation for organ transplantation, 17: 5874
SUTTON, A. L., Porosity in accommodation of thermal expansion in graphite, 17: 6715
SUTTON, Alice, Metabolism of Ca in perinatal period, 17: 5731
SUTTON, Alice, Movement of Sr in body, 17: 5712
SUTTON, David C., Radioactivity of T = 0 states in V-46, Mn-50, Co-54, and Cu-58, 17: 7138 (PUC-1962-61)
SUZUKI, A., Comparison of variable-energy synchrocyclotron and sector-focused cyclotron, 17: 7379
SUZUKI, Arata, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
SVEC, H. J., Absolute abundance of Cr isotopes in secondary minerals, 17: 6257 (IS-438)
SVEC, H. J., Mass spectra of volatile hydrides, 17: 6791 (IS-424)
SVEJDA, J., Rabbit kidney after x irradiation, 17: 5904
SWALLEY, R. F., Design for cast-in-place concrete shelter, 17: 6313 (NP-12349)
SWANSON, K. M., X radiography of radioactive specimens using rotating Pb disk, 17: 6419
SWARUP, G., Microwave solar radiation, 17: 6906
SWENSON, D. A., Achromatic beam transport system, 17: 7336 (BNL-6511 (p.294-302))
SWIFT-HOOK, D. T., Magnetohydrodynamic power generation, 17: 6849
SYBERS, William A., Concentration of Sr at bone tumors, 17: 5729
SYKES, J. B., Sputtering of solids, 17: 6813 (NP-tr-930)
SYKES, J. B., Stability of inhomogeneous plasma, 17: 7436 (NP-tr-928)
SYMON, Lindsay, Intra-arterial P-32 in location of cerebral tumors, 17: 5681
SZABO, Pal, Crystal-structure disorders of fine crystalline carbons, 17: 6694 (AEC-tr-5565)
SZABO, Pal, Neutron diffraction study preparations, 17: 6809 (AEC-tr-5567)
SZABO, Pal, Orientation of large single crystals, 17: 6058 (AEC-tr-5566)
SZABO, Zoltan, Comparison of chemistry of cis- and trans-uranides with

La and transition metals, 17: 6091
SZAYNOK, Anna, Electrification of dust from β-irradiated KCl, 17: 6815
SZCZUREK, Zbigniew, Experimental radiation disease in rabbits, 17: 5912
SZENDY, Ch., Basic equations of the MHD generator, 17: 6817
SZOSTAK, R., Excited state lifetime measurements, 17: 6450
SZPORNY, L., Accumulation of colloidal Au in inflammations, 17: 5679
SZTANYIK, Laszlo, Plasma-Fe concentration in irradiated animals, 17: 5826
SZYMCZAK (SHIMCHAK), R. A., Formation of At-209 and At-207, 17: 7276

T

TABUCHI, A., Gonadal exposure dose in x-ray examination, 17: 6351
TAFT, H. D., Isobar pairs in p-p collisions, 17: 7002
TAGLIAFERRI, G., Relativistic cyclotron, 17: 7361
TAKABAYASI, Takehiko, Rotator model of elementary particles in Minkowski space. I., 17: 6981
TAKABAYASI, Takehiko, Space-time model of particles in Minkowski space. II., 17: 6982
TAKAHASHI, Kosuke, E4 cross-over transition in isomeric decay of Pb-204, 17: 7196
TAKAMORI, Yasuhiko, Incorporation of P-32 into nucleic acids of γ-irradiated tumor cells, 17: 5832
TAKEMOTO, H., Radiation effects on hematopoietic organs, 17: 5872
TALAT-ERBEN, M., Isotopic and isotonic yields in nuclear fission, 17: 7085 (NP-12309)
TALMAN, James D., Energy levels of first rotational band of Ne-20, 17: 7156
TAMBOVTSEV, D. I., Polarization of protons in stripping reactions, 17: 7286
TAME, Kenneth E., Liquid waste disposal in U milling, 17: 7650 (BM-RI-6114)
TAMM, E. I., Photoproduction of π^0 in H and D, 17: 7036
TAMURA, Taro, Branching ratio of E2 transitions, 17: 7208
TAN, T. H., Decays of the ω and η mesons, 17: 6998
TAN, T. H., Pion resonances in π^+-p interactions, 17: 6997
TANAKA, Kichisosuke, Yield strength of Ag–Al, 17: 6685 (UCRL-9992)
TANAKA, S., Product yields in Cu spallation by protons, 17: 7233
TANAKA, Shigetoshi, Microwave emission of cold plasma, 17: 7435 (AEC-tr-5564)
TANK, Raghav, Quasibinary system UFe_4–UAl_4, 17: 6727
TANNER, Howard C., Jr., Sarcoma complicating fibrous dysplasia, 17: 5866
TANNER, Lee E., Structures in Zr–Fe–Sn system, 17: 6527 (TID-7625 (p.30-41))
TANNHAEUSER, Armin, Behavior of the 4f electrons in rare earths under influence of light, 17: 6099
TARASOV, L. P., Grinding stainless steels and heat-resistant alloys, 17: 6625
TARASOV, Yu. A., Equation of state of plasma, 17: 7484
TARJAN, R., Effect of casein on incorporation of Sr, 17: 5745
TARSKI, Jan, Overlapping final-state interactions, 17: 6994
TATARINSKAYA, L. S., Photoproduction of π^0 in H and D, 17: 7036
TATE, Donne J., Materials research and development program, 17: 6532 (WADC-TR-53-373(Suppl.9))
TAYLOR, C., Production of short-lived radioisotopes, 17: 6370
TAYLOR, E. Windle, Radioactivity of water, 17: 6337
TAYLOR, G. R., Analog computer applications in chemical engineering, 17: 5936 (HW-SA-2815)
TAYLOR, G. R., Analog computers in nuclear processes, 17: 6496 (HW-SA-2552)
TAYLOR R. Dean, Expansion coefficient of liquid He-3, 17: 6819
TAYLOR, S., Evidence for $K^+ \to \pi^+ + \pi^- + e + \nu$ decay mode, 17: 6999
TCHOE, Yoono-Tchol, Incorporation of P-32 into nucleic acids of γ-irradiated tumor cells, 17: 5832
TEARE, J. D., Rate of ionization behind shock waves in air. II., 17: 6773 (AFCRL-62-751)
TEBBE, Fred N., Synthesis of a B labeled tetraborane, 17: 5944
TEEGARDEN, K., Emission spectra of KCl : Tl, KBr: Tl, and KI: Tl, 17: 6858
TELITCHENKO, M. M., Metabolism of fish in accumulation of radioisotopes, 17: 5708 (IPRS-15871)

TELLIER, H., Study of enriched fuel by means of pulsed neutron source, 17: 7535 (CEA-2201)
TENCH, A. J., ESR of irradiated quaternary ammonium halides, 17: 6034 (BNL-5559)
TENG, L. C., Superconducting linacs, 17: 7326 (BNL-6511(p.204-5))
TEPLOV, I. B., Excitation of Be-8 in $Li^7(p,\alpha)He^4$, 17: 7179
TEPLOVA, Ya. A., Excitation of Be-8 in $Li^7(p,\alpha)He^4$, 17: 7179
TER-AKOPIYAN, G. M., Determining proton emission by nuclei, 17: 7082 (JINR-P-1072)
TETERIN, E. D., Scintillation method in radiometry, 17: 6444 (AEC-tr-5259)
TEWORDT, Ludwig, Electronic thermal conductivity of superconductors, 17: 6869
THACHER, Henry C., Jr., ALGOL 60, algebraic common language, 17: 6504 (TID-15527)
THANKAPPAN, V. K., Collective vibrations in even-even nuclei with A = 30, 17: 7104 (NP-12330(p.119-21))
THAPER, C. L., Neutron cross sections at thermal and subthermal energy, 17: 7128 (NP-12330(p.369-77))
THEISEN, C. W., Plastic models in thermal stress studies, 17: 6247 (TID-17498)
THIBAULT, Roger, Zemplen theorem in fluid magnetodynamics, 17: 6827
THIELE, D., Fuel reprocessing plants in Europe, 17: 6199
THIKADZE, Zh. S., He(II) rotation near λ point, 17: 6895
THODOS, George, Flow of fluids through beds, 17: 6232
THOMAES, G., Viscosity of liquid deuteromethane, 17: 6094
THOMAS, A., Prog. rpt. on radiation effects in liquid H media, 4–6/62, 17: 6747 (NP-12364)
THOMAS, C. C., Jr., Determination of C transfer characteristics, 17: 6223
THOMAS, E. Donnall, Transplantation of marrow, 17: 5683
THOMAS, G., Direct observations of heterogeneous precipitation, 17: 6687 (UCRL-10124)
THOMAS, J., Rotating rig for dosimeter calibration, 17: 6475
THOMAS, John M., Etching of graphite surfaces, 17: 6722
THOMAS, V. G., Annealing radiation damage of (n,γ) and (γ,n) reactions, 17: 7134 (NP-12330(p.415-21))
THOMPSON, J. Neils, Shock mitigation with vermiculite concrete, 17: 5668 (DASA-1263)
THOMPSON, John E., Freeze-dehydrated irradiated pork, 17: 6365
THOMPSON, Stephen W., Radioisotope method for cerebral circulation, 17: 5711
THOMSON, J. O., Mössbauer-type study of Au-197, 17: 7234
THORN, R. J., Thermodynamic properties of carbides, 17: 6052 (TID-17413)
THORNBURY, T. B., Measurements on Phoenix fuel standards, 17: 5951 (HW-74796)
THORSON, Walter R., Polarization of ligand-field spectra of planar chelate complexes, 17: 6115 (NYO-9868)
THOSAR, B. V., Isotope shifts and internal conversion, 17: 7103 (NP-12330(p.109-18))
THUN, J. E., Internal bremsstrahlung, 17: 7152
THUNBORG, S., Plastic models in thermal stress studies, 17: 6247 (TID-17498)
TICKLE, R. S., University of Michigan 83-inch cyclotron. I., 17: 7364
TICKLE, R. S., University of Michigan 83-inch cyclotron. II., 17: 7365
TIEN, C. L., Law of wall in turbulent channel flow, 17: 6239
TIMUSHEV, G. F., Proton scattering on Ni and Cu, 17: 7178
TINKLER, Almond, Sampling apparatus for obtaining graphite specimens from reactors, 17: 7593
TKACHUK, R., Beta scintillation detector for aqueous solutions, 17: 6446
TOCHILIN, E., Neutron and γ dosimetry in animal exposure volume at TRIGA, 17: 5780 (USNRDL-TR-583)
TODD, H., Material for ion propulsion, 17: 6544
TODD, R., Determination of Sb and Co in Mg-base alloys, 17: 5960 (PG-Report-337)
TODD, R. B., Local heat-transfer coefficients in nuclear reactor, 17: 6236
TODD, R. H., Metallographic studies of Al–Ni–U bonds, 17: 6606
TODT, F., FEVER—program for reactor analysis, 17: 7540 (GA-2749)
TOEPFER, Alan J., Instabilities in plasma injected into B_z field, 17: 7428 (NP-12342)
TOHA, Jose, Polymerization of ribomononucleotides by γ radiation, 17: 5791

TOLFREE, George, Fluid-cooled reactors, 17: 7591
TOMBOULIAN, D. H., Photoelectric K-absorption cross section of Be, 17: 6870
TOMINAGA, T., Electrolyte concentrations of intra- and extracellular compartments in internal diseases, 17: 5694
TOMNOVEC, F. M., Computer-aided analysis of γ spectrometer data, 17: 6442 (USNRDL-TR-592)
TORCHINSKAYA, O. L., Complexons for accelerating elimination of Ce-144, 17: 5739
TORIZUKA, Y., Magnetic elastic scattering of electrons by light nuclei, 17: 7222
TORPOV, N. A., Solid solutions of La orthosilicates, 17: 6101
TOSCHI, R., Plasma research, 17: 7440
TOTH, K. S., Nitrogen nucleus reactions with B-11, F, Al, Si, P, and Cl, 17: 7252
TOTH, K. S., Radiation survey at LRL cyclotron, 17: 7401
TOUSIMIS, A. J., Distribution of Ca in epiphyseal cartilage, 17: 5727
TOWER, S. H., Superheat power experiments in development of nuclear power plants, 17: 7624
TOWNLEY, C. W., Short-lived isotopes in study of reactor fuel materials, 17: 7584
TREBILCOCK, R. J., Fast flux measurements in zero energy reactors, 17: 6483
TREININ, A., Charge-transfer complexes of I, 17: 6038 (IA-763)
TREVINO, S. F., Polarization and angular distributions from $Be^9(p,n)B^9$, 17: 7246
TRIPATHI, R. N., Absolute electron-electron scattering cross section, 17: 7117 (NP-12330(p.193-8))
TRIVISONNO, C. F., Titrimetric determination of U, 17: 5950 (GAT-471)
TRLIFAJ, L., Inserted block in square lattice, 17: 7581
TROMBE, Felix, Separation of rare earth elements, 17: 6069
TROMBE, Felix, Separation of Nd and Pr by distillation, 17: 6070
TROTT, N. G., Measurement of β radioactivity by 4π counting, 17: 6459
TSANDER, F. A., Flight with aid of reactive devices, 17: 7645
TSETLIN, B. L., Radiation synthesis of ion-exchange sorbents, 17: 6140
TSEVELEVA, I. A., Radiation effects on nucleotide metabolism in rabbit liver, 17: 5879
TSUDA, Takao, Electric field fluctuations in electron plasmas. I., 17: 7473
TSUZUKU, T., Prog. rpt. on properties of carbons and graphites, 8–9/62, 17: 6670 (NP-12350)
TSVETKOVA, Z. N., Chemistry of Zr salts, 17: 6097
TSYTKO, S. P., Decay scheme of K-41, 17: 7177
TSYTOVICH, V. N., Radiative corrections to energy losses of particles, 17: 6897
TUBIANA, M., Total-body irradiation for organ transplantation, 17: 5874
TUBIS, A., Behavior of elastic-scattering amplitudes, 17: 7003
TULER-MAGNUSZEWSKI, W., Separation of metals by focusing ion exchange, 17: 6180 (IA-769)
TULER-MAGNUSZEWSKI, W., Separation of precipitates using adhesion on glass, 17: 5952 (IA-772)
TULUPOV, B. A., Optical anisotropy and shape of surface of atomic nuclei, 17: 7302
TUNITSKII, N. N., Dissociation of D_3^+ ions in collisions with D_2 molecules, 17: 6896
TURCOTTE, D. L., Boundary layer resistance and sheath potential in shock tube, 17: 6899
TURKOV, V. D., Tomato mutants induced by γ radiation, 17: 5892
TURNER, C. W., Effect of milk hyperthyroidism upon secretion of I-131 in milk, 17: 5721
TURNER, D. P. B., Vesical hemorrhage after irradiation, 17: 5805
TURNER, John, Effects of 200 kv and Co-60 radiation on jaws and dental structure, 17: 5867
TURNER, P. C. R., Calculation of absorbed tissue doses from As-72, 17: 5735
TURNER, S. E., Prog. rpt. on nuclear superheater, 7–9/62, 17: 7601 (GNEC-254)
TURNER, W. D., Oxidation of UC by CO_2, 17: 6665 (NAA-SR-7482)
TUTAKIN, P. M., Polarization of γ rays from $Si^{28}(p,\gamma)P^{29}$, 17: 7278
TWITTY, B. L., Determination of U^{235} in impure U materials, 17: 5979 (TID-15359)
TZUI, Wang-chuang, Polarization correlation C_{nn} and scattering amplitude moduli for pp scattering, 17: 6949 (JINR-D-1073)

U

UCHIDA, Yoichi, Cathodeluminescence of BeO, 17: 6089
UCHIYAMA, J., Internal contamination by Sr-90, 17: 5744
UHLMANN, W., Bibliography on determination of radioactive isotopes in urine, 17: 5981 (VDIT-66)
UKITA, T., Internal contamination by Sr-90, 17: 5744
UMAKANTHA, N., Inelastic scattering of cold neutrons in BeO, 17: 7130 (NP-12330(p.384-91))
UPHAM, F. T., Vacuum sentinels for ultracentrifuges, 17: 6221
URBAIN, P., Radioactivity of thermal waters, 17: 6281
USHAKOVA, V. F., Complexons for accelerating elimination of Ce-144, 17: 5739
USIK, P. A., Inelastic nucleon-nucleon interactions, 17: 7040
UST'YANOV, V. I., Gamma conductivity in CdS crystals, 17: 6886
UTTERBACK, Nyle G., Ionization of N and O molecules by N and O molecules, 17: 6864

V

VACHASPATI, Scattering of EM radiation by free electrons, 17: 7114 (NP-12330(p.172-8))
VACZO, G., Regeneration of liver of x-irradiated rats, 17: 5854
VAGER, Z., Gyromagnetic ratio of 2^+ state of Os-188, 17: 7225
VAGRADOV, G. M., Statistical nuclear model, 17: 7284
VAIL, Virgil W., Power supply and control circuit for ion-getter pumps, 17: 6219
VALADARES, Manuel, Gamma radiation during decay $Th^{234} \rightarrow Pa^{234}$, 17: 7160
VALADE, M., Chemical processing apparatus for radioisotopes of short half life, 17: 6169
VAL'DSHTEIN, E. A., Radioprotective action of cysteamine in irradiation of *E. coli*, 17: 5932
VALENTA, M. W., Ferroelectric solid solutions possessing relatively large spontaneous polarizations, 17: 6678 (TID-14508)
VALENTIN, Jacques, Gamma spectra and periods of Hf-170, 171 and Lu-170, 171, 17: 7162
VALERINO, M. F., Prog. rpt. on nuclear superheater, 7–9/62, 17: 7601 (GNEC-254)
VAL'TER, A. K., Decay scheme of K-41, 17: 7177
VANAGAS, V. V., Theory of angular momentum, 17: 7527
VANCURA, A., Decay rate of bound muons, 17: 6968
VAN DER DOES DE BYE, J. A. W., Signal-to-noise ratio of p-n junction counter, 17: 6458
VANDERHAEGHE, G., Nuclear fission induced by 600-Mev protons, 17: 7086 (NP-12319)
VANDERSALL, J. H., Effect of thyroidal I-131 release rates, 17: 5723
VANDERSLICE, T. A., Small bakeable mass spectrometer, 17: 6379 (61-RL-2501G(Rev.))
VANDERVOORT, Richard R., Compressive creep of BeO, 17: 6684 (UCRL-6748)
VAN DIJK, C., Measurement of neutron densities, 17: 6474
VAN DYK, G., Resonant electron capture and stripping in Ne^+–Ne collisions, 17: 6863
VAN ECK, J., Excitation processes in He, 17: 7263
VAN GOOL, W., Fluorescence centers in ZnS, 17: 6092
VAN LEUVEN, P., "Center of gravity" theorem, 17: 7508
VAN LUIK, Frank William, Jr., Condensation nuclei detector, 17: 6488
VAN PUTTEN, L. M., Treatment of Sr-90 intoxication in mice. I., 17: 5717
VAN PUTTEN, L. M., Treatment of Sr-90 intoxication in mice. II., 17: 5718
VAN REGEMORTER, Henri, Collisional excitation in stellar atmospheres, 17: 6905
VAN ROOYEN, H. O., Cape Town anomaly, 17: 6850
VAN SICKLE, Dale E., Secondary D isotope effect on the maleic anhydride–cyclopentadiene reaction, 17: 6122
VAN SOESTBERGEN, A. A., Relationship between effect and O concentration in irradiation experiments, 17: 5833
VAN STEENBERGEN, A., AGS preinjector beam emittance area and emittance area density distribution, 17: 7342 (BNL-6511(p.338-80))
VAN STEENBERGEN, A., Conference on linear accelerators, 8/62,

17: 7308 (BNL-6511)
VAN UITERT, L. G., Intensities of emission of Eu^{3+} and Tb^{3+} in W, 17: 6837
VAN WIJK, A. M., Magnetic effects of high-altitude bomb, 17: 6841
VAN WIJNGAARDEN, Arie, Energy loss in condensed matter of H^3 and He^4, 17: 7157
VANYUKOV, M. P., Effect of magnetic field on pulsed discharge in Ar, 17: 7486
VARAGIC, V., Effect of x radiation and cysteamine on barbiturate response, 17: 5788
VARDI, Joseph, Thermal conductivity of graphites, 17: 6640 (ASD-TDR-62-608(Pt.I))
VASIL'EV, I. M., Radiation effects on plants, 17: 5905
VASIL'EV, S. S., Proton scattering on Ni and Cu, 17: 7178
VAUCHER, B., Efficiency of detector shielding, 17: 7067
VAUCHER, B., Light yield of solution NE 213 to protons, 17: 6119
VAVILOV, V. S., Radiation defects in Si, 17: 6767
VDOVENKO, M. E., Separation of rare earths by chromatographic method, 17: 6009
VELLUZ, Leon, Determination of urea, 17: 6032
VENKATARAMAN, B., Dynamic polarization of nuclei using magnetic resonance, 17: 7123 (NP-12330(p.224-41))
VENKATESWARLU, K. S., Corrosion and deposition on fuel rod cladding, 17: 6587
VENKATESWARLU, K. S., Nuclear recoil following radiative capture of neutrons by Co-59, 17: 7133 (NP-12330(p.407-14))
VENKATESWARLU, P., NMR spectra of A_3B_2X system, 17: 7124 (NP-12330(p.242-8))
VENKITASUBRAMANIAN, T. A., Effect of x radiation on hepatic synthesis of fatty acids, 17: 5792
VENTERS, Lydia, Scintillation method in radiometry, 17: 6444 (AEC-tr-5259)
VERGA, L., Radioprotection of the embryonic cell, 17: 5914
VERHAEGEN, G., Heats of vaporization of solids. I., 17: 6095
VERNOV, S. I., Inner radiation belt at 320 km in South Atlantic magnetic anomaly, 17: 6937
VERNOV, S. N., Outer radiation belt of earth at 320 km, 17: 6936
VERSTER, N. F., Analog studies for an AVF cyclotron, 17: 7388
VERSTER, N. F., Computer programs for an AVF Cyclotron, 17: 7387
VERSTER, N. F., Design of Philips AVF prototype, 17: 7363
VERSTER, N. F., Orbits in an AVF cyclotron, 17: 7381
VERWEIJ, H., Design of fast pulse amplifier, 17: 6389 (CERN-62-32)
VIALE, F., Detection of ionization in dielectrics, 17: 6412 (SCL-T-447)
VICTOR, George, Fused nitrates and nitrites, 17: 6080
VIDAL, Jose G., Elastic scattering of 31-Mev He^3 ions, 17: 7148 (UCRL-9996)
VIGIER, Jean-Pierre, Rotator model of elementary particles in Minkowski space. I., 17: 6981
VIGIER, Jean-Pierre, Space-time model of particles in Minkowski space. II., 17: 6982
VIJAYARAGHAVAN, R., Quadrupole coupling constants of Na-23 and B-11, 17: 7127 (NP-12330(p.295-301))
VIKTURINA, V. P., Radiation safety in x-ray rooms, 17: 6361
VILKOVISKII, E. Ya., Lifetime of the level 4^+ (1282 kev) of Cd-114, 17: 7283
VILLA, F., Tunnel diode fast discriminator circuit, 17: 6399 (LNF-62/73)
VILLOUTREIX, J., Biosynthesis of carotenoids, 17: 5809
VINOGRADOV, A. P., Determination and analysis of rare earths, 17: 6018
VINOGRADOV, M. F., Effect of whole-body irradiation on lipid turnover in brain, 17: 5882
VISCONTI, J. A., Extrusion of refractory alloys, 17: 6589 (ASD-TDR-62-670)
VISSCHER, William M., Resonance absorption of gammas by impurity nuclei, 17: 6854
VITA, O. A., Titrimetric determination of U, 17: 5950 (GAT-471)
VIVIANI, G., Post-irradiation proctitis, 17: 5893
VLAHOVIC, S., Whole-body radiation effects on guinea pigs, 17: 5783
VOGEL, Howard H., Jr., Acquired radioresistance, 17: 5776 (TID-14698)
VOGEL, Howard H., Jr., Rate of recovery from radiation injury, 17: 5909 (TID-14019)
VOGT-NILSEN, N., Isochronous cyclotron meson factory, 17: 7395
VOITYUK, V. M., Leukopenia in acute radiation shock, 17: 5853
VOLKOV, Yu. M., Deuteron emission in photodisintegration of O-16, 17: 7295
VON EGIDY, Till, Neutron capture spectrum of Sm-150, 17: 7273
VON GEHLEN, G., Spin correlation in muon pair production, 17: 6952 (LNF-62/75)
VORONKOVA, L. I., Tomato mutants induced by γ radiation, 17: 5892
VORONOV, G. S., Sensitivity of liquids to radiation, 17: 6472
VORTMAN, L. J., Nuclear explosives for improving H_2O resources, 17: 5658 (TID-16647)
VOS, O., Protection of rat thymocytes irradiated *in vitro*, 17: 5922
VOS, O., Sensitivity of mouse bone-marrow cells x-irradiated *in vitro*, 17: 5831
VOSKOBOYNIKOV, G. V., Iron metabolism in radiation sickness, 17: 5913
VOZNESENSKII, S. A., Solubility of inorganic salts in organic solvents, 17: 6190 (AEC-tr-5574)
VUILLEMEY, R., Ammonium diuranate precipitation, 17: 5935 (CEA-2204)
VYAZEMSKII, V. O., Scintillation method in radiometry, 17: 6444 (AEC-tr-5259)

W

WACHSMANN, Felix, Burden to surface in rotational irradiation, 17: 6359
WACHSPRESS, Eugene L., Multidimensional neutron group diffusion computations, 17: 7057 (TID-14262)
WADDELL, Charles N., Scattering of 31.1-Mev protons by C-12, 17: 7243
WAGENER, H. H., Biological action of x radiation, 17: 5813
WAGHMARE, Y. R., Nuclear interaction in $T = 1$ $p^{1/2}$ doublets, 17: 7105 (NP-12330(p.122-5))
WAGNER, H., Influence of irradiation on skin lipids, 17: 5825
WAGNER, Henry N., Jr., Radioisotope scanning of precordial distribution of I, 17: 5685
WAGNER, K. H., Investigation of electron avalanche with image intensifier, 17: 7018
WAGNER, L., Computations for fallout, 17: 5749 (CDRP-182-113)
WAGNER, O., Influence of irradiation on skin lipids, 17: 5825
WAHLBECK, Phillip G., Chemical thermodynamics of materials at high temperature, 17: 6043 (NP-12310)
WAHSWEILER, Hans Georg, Muon absorption exchange effect in Cl-35 and Cl-37, 17: 7274
WALDKOETTER, G. L., Ultrasonic inspection of thick wall steel pipe, 17: 6243 (HW-74597)
WALKER, C. R., Titrimetric determination of U, 17: 5950 (GAT-471)
WALKER, Donald C., Adsorption of radiolabeled compounds, 17: 6078
WALKER, P. L., Jr., Prog. rpt. on graphite, 4/1/62–3/31/63, 17: 6531 (TID-17504)
WALKER, R. M., Radiation damage in metals, 17: 6732 (62-GC-207)
WALKER, R. M., Radiation damage in metals, 17: 6733 (62-GC-209)
WALL, Gaylord, Bubble chamber track-centering device, 17: 6464
WALL, James A., Biological effectiveness of protons and α particles, 17: 5770 (MDC-TDR-62-3)
WALLACE, F. B., Prog. rpt. on SPUR program, 7–9/62, 17: 7610 (SY-5396-R2)
WALLACE, R. M., Chloro complexes of nitrosylruthenium, 17: 6051 (TID-15360)
WALLACE, Roger, Shielding for meson factory, 17: 7393
WALSH, John T., Separation of complex mixtures, 17: 6000
WALT, M., Comments on paper by Hess and Poirier, 17: 6930
WALT, M., Trapped electrons injected by nuclear detonations, 17: 6839
WALT, Martin, Diffusion of electrons in Van Allen belt. I., 17: 6924
WALT, Martin, Diffusion of electrons in Van Allen belt. II., 17: 6925
WALT, Martin, Diffusion of electrons in Van Allen belt, 17: 6941
WALTER, J. B., Inhibition of x-ray damage to guinea pig skin, 17: 5915
WALTHER, H., Nuclear quadrupole moment of Mn-55, 17: 7275
WALTHER, V., Emission from C, Cu, and Au on bombardment by noble gas ions, 17: 7268
WALTON, Alan, Deposition of Be-7 and P-32 precipitation, 17: 6840
WARD, C. H., Prog. rpt. on thermodynamics of refractory compounds, 9-11/62, 17: 6045 (RAD-SR-62-251)
WARD, Charles S., Prog. rpt. on gas duplexer, 1/62–3/62, 17: 6403 (RADC-TDR-62-254)
WASAN, D. T., Law of wall in turbulent channel flow, 17: 6239
WASSERMAN, L. R., Turnover of Fe and vitamin B_{12}, 17: 5746

WASSERMAN, R. H., Bibliography of Sr and Ca metabolism, 17: 5747
WATANABE, H. T., Prog. rpt. on hydrazine process development, 8–10/62, 17: 6123 (AGN-AN-756)
WATANABE, I., Method of thyroid I-131 uptake, 17: 5743
WATERTON, P. J., Operation of 40-inch cyclotron, 17: 7354
WATSON, C. D., Aqueous processing of Th fuels. II., 17: 6186 (ORNL-TM-420)
WATSON, P. G., Magnetic cone for Berkeley cyclotron, 17: 7390
WATT, J. S., Applications of short half-life radioisotopes, 17: 6375
WEAVER, Charles L., Radiological safety at Hardtack, 17: 6317 (OTO-58-3)
WEBB, R. B., Glycerol and oxygen effects on x-ray sensitivity, 17: 5771 (TID-13275)
WEBB, R. M., Design for cast-in-place concrete shelter, 17: 6313 (NP-12349)
WEBBER, Lorence Marcine, Electronic entropy in liquid metal solutions, 17: 6044 (NP-12311)
WEBBER, W. R., Forbush decrease measurements, 17: 6929
WEBBER, William, Production of free electrons in D layer, 17: 6927
WEDDIGEN, C., Polarization in $C^{13}(d,p)C^{13}$ between 0.8 and 1.2 Mev, 17: 7271
WEDDIGEN, C., Reaction $Li^7(p,\alpha)He^4$ between 1 and 3.2 Mev, 17: 7272
WEEGE, Chr., Decomposition in stored carrier-free NaI^{131} solutions, 17: 5693
WEEKS, John R., Corrosion in alkali liquid metal systems, 17: 6557
WEGST, Audrey V., Mercury-203 labeled neohydrin, 17: 5841
WEHNER, R. S., Collision cross sections and atomic scattering, 17: 6774 (AFCRL-531(I))
WEICHOLD, Betty, Bioenvironmental features of Ogotoruk Creek Area, Alaska, 17: 6273 (TID-17226)
WEIL, J. A., Non-linear conductivity of plasma for MHD power generation, 17: 7491
WEIL, John A., Radiation-produced defects in doped quartz, 17: 6749 (TID-15542)
WEINMAN, J. A., Excited states of light nuclei, 17: 6779 (ANL-6603 (p.47-52))
WEINREB, Sander, Galactic 21-cm H line, 17: 6910
WEINREICH, Marcel I., Detection of ionization in dielectrics, 17: 6412 (SCL-T-447)
WEINREICH, Marcel I., Obtaining a polymer based on p-diethynylbenzene, 17: 6117 (SCL-T-446)
WEINREICH, Marcel I., Radiospectroscope limit sensitivity, 17: 6413 (SCL-T-449)
WEINSTEIN, D., Prog. rpt. on Zr alloys, 7/1/62–9/30/62, 17: 6561 (ARF-2198-34)
WEISSKOPF, V. F., Superconductivity and quantization of magnetic flux, 17: 6784 (CERN-62-30)
WELLS, M. J., Conference on spectroscopy, London, Mar., 1962, 17: 6023
WELLWART, Y., Chemical separation for radiomanganese, 17: 6128 (ORNL-TM-438)
WEMPLE, Bruce D., Preparation of BC, Zy-2 samples, 17: 6526 (TID-7625 (p.20-9))
WENDBERG, Bo, Mineral metabolism of fractures of the tibia, 17: 5678
WENDEN, Henry E., Final rpt. on thermoelectric materials, 1/1/60–9/30/61, 17: 6633 (AD-274831)
WENDLANDT, W. W., Thermal decomposition of the rare earth sulfates, 17: 6054 (UCRL-6500)
WESEMANN, Ingrid, Radiation effects on glucose and fatty acid transport in small intestine, 17: 5933
WEST, H. I., Jr., Electron spectrum observed on Discoverer satellites, 17: 6917 (UCRL-6792-T)
WEST, N. D., Nimrod injector, 17: 7312 (BNL-6511(p.38-49))
WEST, R., Production of short-lived radioisotopes, 17: 6370
WEYGAND, Friedrich, Recrystallization of D-mannose-l-t phenylhydrazone, 17: 6118
WHAN, R. E., Spectroscopic studies of rare earth chelates, 17: 6085
WHARTON, Lennard, Molecular constants of Li hydride, 17: 6077
WHATLEY, Malcolm C., CP invariance and K_1^0 regeneration, 17: 6995
WHEELER, Burton E. Vernon, Photometric determination of B, 17: 5998
WHEELER, G. W., Drift tube linacs, 17: 7313 (BNL-6511(p.50-64))
WHEELER, G. W., R-f power developments, 17: 7337 (BNL-6511(p.303-5))
WHETSTONE, Albert L., Photographic method of coding counter pulses, 17: 6469
WHIFFEN, D. H., Electron spin resonance and applications, 17: 5692
WHIPPLE, G. Hoyt, Exposures in using radioisotopes, 17: 6320 (TID-16553)
WHITE, George, Measuring static gas pressures in pressure vessels, 17: 6429
WHITE, W. H., Jr., Beam-phase measurement studies, 17: 7410
WHITE, W. H., Jr., Features in Oak Ridge isochronous cyclotron, 17: 7357
WHITE, W. H., Jr., Magnet regulators for ORIC, 17: 7376
WHITHAM, K., Geomagnetic observation of high-altitude nuclear detonation, 17: 6283
WHITING, M., Production of short-lived radioisotopes, 17: 6370
WICHERS, Edward, Report of International Commission on Atomic Weights (1961), 17: 6072
WIDDER, F., Improvement of coincidence method, 17: 6448
WIDDOWSON, Elsie M., Metabolism of Ca in perinatal period, 17: 5731
WIECHERS, G., Nuclear resonant scattering of γ radiation, 17: 7229
WIEGAND, Clyde, Antiproton-nucleon cross sections, 17: 6959 (UCRL-9288(Rev.))
WIGGINS, A. D., Cesium-137 in dried milk products, 17: 5752 (HW-SA-2337)
WIGGINS, M. T., Automatic foil activity counting facility, 17: 6494 (ANL-6628)
WIJNEN, M. H. J., Photolysis and radiolysis of iodoethane, 17: 6130 (RRL-78T)
WILCOX, J. M., Origin of satellites and planets, 17: 6908
WILETS, L., Nuclear many-body problem with nonuniform density. I., 17: 7260
WILHELM, H. A., Pure metals from chemical processes, 17: 6515 (IS-394)
WILKE, C. R., Diffusion in mixed solvents, 17: 6060
WILKINSON, W. D., Uranium Metallurgy. I., 17: 6539
WILKINSON, W. D., Uranium Metallurgy. II., 17: 6540
WILLARD, John E., Radiation chemistry of solid hexabromoethane, 17: 6150
WILLAX, H. A., Electrostatic deflector for Berkeley cyclotron, 17: 7404
WILLAX, H. A., Geometry of Berkeley 88-inch cyclotron, 17: 7389
WILLAX, Hans, Spill beam from 88-inch cyclotron, 17: 7356
WILLIAMS, B. R., Etching of graphite surfaces, 17: 6722
WILLIAMS, Ffroncon, Radiation polymerization of cyclopentadiene at −78°, 17: 6149
WILLIAMS, Katherine, Radiation and health, 17: 5906
WILLIAMS, S. L., Determining source of nuclear system pipe wall radiation, 17: 6574 (TID-15281)
WILLIAMSON, J. M., Protons and electrons at 12 earth radii, 17: 6922
WILLIS, B. T. M., Neutron diffraction equipment at DIDO reactor, 17: 6417
WILLMARTH, T. E., Cintel flying spot microscopy, 17: 6529 (TID-7625 (p.52-62))
WILLS, John G., Magnetic moments of μ-mesonic atoms, 17: 7213
WILSON, C., Sensitization of blood vessels to damage by x irradiation, 17: 5844
WILSON, L. D., Spread F development, 17: 6848
WIMMENAUER, W., Deposits of U in Western Europe, 17: 6292
WIMUNC, E. A., Preparing EBWR for high power operation, 17: 7612 (TID-14697)
WINKLER, H., Determination of resonance and threshold energies. II., 17: 7173
WINSLOW, J. W., Radiation effects in thermoelectrics. I., 17: 6441 (USNRDL-TR-581)
WINTER, Chester C., Iodine-125 for labeled hippuran renogram, 17: 5728
WISCHOW, R. P., Thorex Th nitrate product specifications, 17: 6185 (ORNL-2056)
WISE, M. E., Irradiation and leukemia, 17: 5803
WISHNIA, Arnold, Nature of slowly exchanging protons of RNA, 17: 6073
WITT, J. R., Preparation of lanthanon acetates, 17: 6082
WITTE, H., Radiation protection doors of steel, 17: 7504
WITTE, S., Clinical results of bone marrow transfusions, 17: 5921
WOEHLER, K. H., Anomalous diffusion in positive column in magnetic field, 17: 7475
WOLF, Bernardo, Behavior of charged particle in sinusoidal E-M, 17: 6816
WOLF, N. S., Cells conferring restorative activity on irradiated mice, 17: 5810
WOLFERS, H., Polycythemia vera, 17: 5687
WOLFF, P. A., Nuclear relaxation as probe of electron spin correlation,

17: 6856
WOLFF, Sheldon, Kinetics for two-break chromosome exchanges, 17: 5690
WOLFF, W., Design of spiral ridge cyclotron, 17: 7397
WOLFGANG, R., Recoil study of $Al^{27}(p,3pn)Na^{24}$, 17: 7230
WOLLAM, J. S., Improved diffractometer radiation shield, 17: 6220
WONG, How-sen, Regge poles and inelastic scattering at high energies, 17: 7513
WONG, Philip, Oxidation of graphites at elevated temperatures, 17: 6689 (WAL-TR-851.4/2)
WOOD, W. D., Thermal radiative properties of materials, 17: 6650 (DMIC-177(Vol.I))
WOODBRIDGE, A. V., Creep test apparatus for use with explosives, 17: 6242 (AWRE-O-34/62)
WOOLF, Michael A., Energy gas in superconductors, 17: 6878
WOOLSEY, Charles C., Nuclear fuel element for space, 17: 6559
WORLOCK, R., Material for ion propulsion, 17: 6544
WORSHAM, R. E., Features in Oak Ridge isochronous cyclotron, 17: 7357
WORTLEY, G. A., Protection from harmful effects of radionuclides in food, 17: 6338
WRIGHT, Byron T., Design of U.C.L.A. cyclotron, 17: 7353
WRIGHT, J. H., Superheat power experiment in development of nuclear power plants, 17: 7624
WRIGHT, J. K., Magnetohydrodynamic power generation, 17: 6849
WU, Fa Yueh, Ground state of liquid He-4, 17: 6883
WU, Te-You, Quantum theory of scattering, 17: 7053
WUEHRMANN, Arthur H., Responsibility of dental profession in reducing radiation exposure, 17: 6349
WYLY, L. D., Beta-γ directional correlations in Re-186 and Tm-170, 17: 7218
WYLY, L. D., Beta-γ directional correlation in Re-188, 17: 7223

Y

YAGODA, Herman, Bioastronautical measurements of radiation in space, 17: 5765 (AFCRL-62-244)
YAKOVLEVA, I. V., Depolarization of μ^+ mesons in solids, 17: 7046
YAKUNIN, V. N., Dosimeter for x- and γ radiation, 17: 6471
YALE, Seymour H., X-ray barrier efficiency of building materials, 17: 6720
YAMADA, O., Efficiency in liquid scintillation counting, 17: 6454
YAMAGATA, Noboru, Cesium-137 in Japanese people, 17: 5691
YAMAGUCHI, Hisashi, Survey of nuclear reactions induced by 57-Mev protons. I., 17: 7197
YAMAGUCHI, Katsuya, Experiments with electrostatic lenses, 17: 6810 (CEA-tr-X-477)
YAMAMOTO, Albert S., Prog. rpt. on Nb-rich region of ternary phase diagrams, 6/1–9/1/62, 17: 6652 (DRI-2057)
YAMAMOTO, B. Y., Radiolysis of liquid isobutane, 17: 6134 (UCRL-9924)
YAMASAKI, Shuichiro, Singularity of t-matrix of fermion systems, 17: 7006
YANG, J. Y., Radiolysis of *o*-terphenyl with α particles, 17: 6139
YANG, Kang, Free radical reactions. II., 17: 6145
YARAMIS, B., Differential cross sections for $C^{13}(d,n)N^{14}$ and $O^{18}(d,n)F^{19}$, 17: 7239
YAROSLAVTSEVA, N. A., Therapy of acute radiation sickness, 17: 5925
YAROV, A. S., Polarization properties of synchrotron radiation, 17: 7418
YARTSEV, E. I., Radiation-induced chemical changes in tryptophan, 17: 6163
YASHIN, D. A., Production of short-lived isotopes in VVR-M reactor, 17: 6170
YATES, P., Deuterium exchange by diazo-acetyl group, 17: 6067
YAVOR, I. P., Deuteron emission in photodisintegration of O-16, 17: 7295
YBARRONDO, L. J., Effects of surface heat transfer on thermoelectric generator, 17: 6222
YELLIN, E., Determination of C–H ratios by neutron scattering, 17: 5949 (BNL-5814)
YENISCAVICH, W., Effects of burnup on ceramic fuel, 17: 6755
YOFE, J., Separation of precipitates using adhesion on glass, 17: 5952 (IA-772)
YOFE, Y., Separation of metals by focusing ion exchange, 17: 6180 (IA-769)
YOSHIDA, Hiroshi, Branching ratio of E2 transitions, 17: 7208
YOSHINAGA, H., Gonadal exposure dose in x-ray examination, 17: 6351
YOSHINAGA, S., Gonadal exposure in the infant, 17: 6352
YOUNG, D., Drift tube linacs, 17: 7315 (BNL-6511(p.76-97))
YOUNG, Durward D., Jr., *In situ* measurements of elastic properties, 17: 6275 (UCRL-6477)
YOUNG, James A., Electromagnetic properties of charged vector meson, 17: 6961 (UCRL-9889)
YOUNT, R. E., Properties of Mar-Strained steels, 17: 6639 (ASD-TDR-62-230)
YPSILANTIS, Tom, Antiproton-nucleon cross sections, 17: 6959 (UCRL-9288(Rev.))
YUDEN, N. P., Probabilities of single-particle transitions, 17: 7191
YUDIN, N. P., Effects of nucleon surface reaction on O-16 photospallation, 17: 7193
YUDIN, N. P., Particle-hole interactions in shell model, 17: 7192
YUKAWA, Y., Reverse isotope effect of C-14 in Beckmann rearrangement, 17: 6065
YUREV, B. A., Cross sections for photoproton reactions in Pb, 17: 7289
YUTSIS, A. P., Theory of angular momentum, 17: 7527
YUZVUK, N. N., Monitoring fuel element integrity, 17: 7583

Z

ZADUMKIN, S. N., Surface tension of liquid metals, 17: 6708
ZAGANESCU, Mircea, Equations of relativistic magnetohydrodynamics, 17: 6829
ZAIKOV, R., Isobaric scheme for elementary particles, 17: 6967
ZAITSEVA, N. G., Reactions (p,xn) and (p,2xn) type on Te isotopes, 17: 7297
ZAKUTINSKII, D. I., Handbook on toxicology of radioisotopes, 17: 5748
ZAMRIK, S. Y., Nozzle connections of pressure vessels. I., 17: 6246 (NYO-10147)
ZAMYATKINA, O. G., Biosynthesis of serum albumin during radiation sickness, 17: 5928
ZANDER-PRINCIPATI, Gloria E., Concentration of Sr at bone tumors, 17: 5729
ZAVOISKII, E. K., Capture and containment of plasma, 17: 7485
ZEIDMAN, B., Studies of pickup reactions, 17: 6780 (ANL-6603(p.52-5))
ZEL'DOVICH, Ya. B., Pre-stellar state of matter, 17: 6916
ZERNE, Stanley R. M., Cytologic response in radiation of cancer, 17: 5864
ZHABOTINSKII (ZHABOTINSKIY), M. E., Radiospectroscope limit sensitivity, 17: 6413 (SCL-T-449)
ZHDANOVICH, G. M., Pressing metal powders and their mixtures, 17: 6603 (JPRS-16573)
ZHEREBCHENKO, P. G., Distribution of indox alkylamines exhibiting radioprotective properties, 17: 5931
ZHIZHIN, E. D., Inelastic diffraction at high energies, 17: 7522
ZHURAVLEV, D. A., Antimatter in cosmic rays and outer space, 17: 6915
ZIEGLER, N. F., Concepts of an Mc^2 cyclotron, 17: 7396
ZIEGLER, N. F., Regulator for ORNL 83-inch cyclotron, 17: 7380
ZIMMERMAN, Robert, Neutron cross sections of Pr, Yb, and Lu, 17: 7078 (IEA-51)
ZIMMERMANN, H. J., Prog. rpt. on electronics, 6–8/62, 17: 6801 (TID-17303)
ZINK, J. W., Quantized magnetic flux and nature of electrical currents, 17: 6804 (UCRL-6630-T)
ZITTEL, H. E., Determination of U(IV) in Na phosphate electrolyte, 17: 5990
ZITTEL, H. E., Determination of Th^{+4}, 17: 5995
ZMUDA, A. J., Solar protons and magnetic storms, July 1961, 17: 6920
ZOMBKOVSKII, S. M., Multiple production of π mesons in πp collisions, 17: 7035
ZORN, B. Sechi, Bubble density in hydrogen bubble chamber, 17: 6383 (BNL-5866)
ZORN, G. T., Bubble density in hydrogen bubble chamber, 17: 6383 (BNL-5866)
ZOTOVA, M. G., Effect of unithiol on resorption of Po, 17: 5759
ZUCKER, A., Concepts of an Mc^2 cyclotron, 17: 7396
ZUCKER, A., Radiation survey at LRL cyclotron, 17: 7401
ZUCKERMAN, S., X-ray sterilization of female rats, 17: 5838
ZUL'KARNEEV, R. Ya. (Ju.), Polarization correlation C_{nn} and scattering amplitude moduli for pp scattering, 17: 6949 (JINR-D-1073)
ZUPANCIC, C., Production of particles by 30-Bev protons on Al, Be, and

Fe, 17: 7259
ZUPANCIC, I., Correcting magnetic field inhomogeneities, 17: 6418
ZURAKOWSKA-ORSZAGH, Janina, Intrinsic viscosity of acrylamides polymerized in solid state, 17: 6129 (PAN-308/XVII)
ZWANENBURG, J., Design of Philips AVF prototype, 17: 7363
ZWICKER, Ulrich, Corrosion-resistant Zr alloys, 17: 6579
ZWIKKER, C., Modification changes of zircon and Hf, 17: 6814 (UCRL-Trans-887(L))
ZYCH, W., Determination of resonance and threshold energies. II., 17: 7173

SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries. A more complete description of the patterns and style of indexing used is included in the introductions to the subject index cumulations that are issued quarterly.

As an aid to the users of this index, references to report numbers, where appropriate, are included after the abstract number of the citation.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number in that volume. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. Published literature (journal article or book) is identifiable by the absence of a report number.

A

A-286 ALLOY
drilling, 17: 6615
machining characteristics, 17: 6609
machining, optimum feeds and speeds, 17: 6610
milling, 17: 6612
ACCELERATOR TUBES
design, 17: 7315 (BNL-6511(p.76-97))
design of, for linear accelerators, 17: 7313 (BNL-6511(p.50-64))
ACCELERATORS
beam loading in, analysis of mechanisms of, 17: 7334 (BNL-6511 (p.283-8))
characteristics of Western European, 17: 7351
comparison of various types, 17: 7392
development of preinjector ion sources for, 17: 7340 (BNL-6511 (p.323-34))
orbit stability investigation in circular, using computer program, 17: 7345 (TID-15535)
power supplies for, survey of r-f, 17: 7338 (BNL-6511(p.306-17))
shielding requirements for meson beam facilities, 17: 7393
stability in sector-focused, 17: 7382
stable betatron oscillations of, in a nonlinear magnetic field, 17: 7417
ACETALDEHYDE
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
ACETATES
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
ACETIC ACID, [(CARBOXYMETHYLIMINO)BIS(ETHYLENENITRILO)] TETRA-
effectiveness in elimination of cerium-144 from rats, 17: 5739
effectiveness in treatment of plutonium poisoning in mice, 17: 5706 (TID-14893)
ACETIC ACID, (ETHYLENEDIAMINE)TETRA- COMPLEXES
analysis for rare earths, spectrophotometric, 17: 6010
ACETIC ACID, ISOPROPYL ESTER
dissociation and rearrangement of deuterated, under electron impact, 17: 6164
ACETIC ACID, OXYBIS(ETHYLENENITRILO) TETRA-
effectiveness in elimination of cerium-144 from rats, 17: 5739
ACETIC ACID, VINYL ESTER POLYMERS
particle scattering by VYNS, energy-loss spectra from, 17: 7157
radioinduced reactions of, effects of linear energy transfer on, 17: 6127 (NP-12303)
ACETOPHENONES
deuterium exchange reactions, 17: 6067
ACETYLENE
chemical effects on work function of iridium surface, 17: 6660 (IS-462)
pyrolysis, 17: 6531(R) (TID-17504)
ACIDS
determination of free, in ammonium fluoberyllate, 17: 6017
ACRIDINES
x-ray scattering by, 17: 6062
ACRYLAMIDE
viscosity of polymers of, 17: 6129 (PAN-308/XVII)
ACRYLIC ACID POLYMERS
radioinduced reactions with silica gel, 17: 6140
ACRYLONITRILES
radioinduced polymerization of ethylene and, yield from, 17: 6166
ACTINIDES
chemistry of, compared with lanthanides and transition metals, 17: 6090
chemistry of, compared with lanthanides and transition metals, 17: 6091
determination by ignition, prevention of spattering in, 17: 5976 (TID-14592)
thermodynamics, 17: 6105
thermodynamics of, symposium on, 17: 6104
ACTIVATION ANALYSIS
measurement of gamma spectra in neutron, 17: 6028
neutron, methods for epithermal and fast, 17: 7306
reactor-produced radioisotopes for neutron, 17: 6026
research programs on, 17: 6132(R) (TID-17272)
use of short-lived activities in neutron, 17: 6029
use of short-lived isotopes in neutron, 17: 6031
use of 10-kw Argonaut for neutron, 17: 6030
ADENOSINEPHOSPHORIC ACIDS
protective effects against radiation injury in chick embryos, 17: 5914
ADIPIC ACID
radioinduced free radicals in urea inclusion compounds of, 17: 6162
ADSORPTION
of ions on metals for low fractional surface coverage, 17: 6803 (UCRL-6389)
AERIAL SURVEYING
of gamma radiation in region of Los Angeles, 17: 6253 (CEX-59.4.16)
of gamma radiation in Galveston, Tex., area, 17: 6254 (CEX-62.6.1)
system intercalibration, 17: 5753 (NRL-5850)
AEROSOLS
electrostatic classification of submicron particles in, equipment for, 17: 6304(R) (ARF-3187-10)
fallout diffusion and dispersion in atmospheric, in 1959, 17: 6285
monitoring alpha and beta emitters in, design of high-quality filters for, 17: 6287
AGE ESTIMATION

radiocarbon method for, 17: 6295
radiocarbon method for, 17: 6298
radiocarbon method for, 17: 6299
AIR
electric discharge in, evolution of positive, 17: 7575(T) (CEA-tr-A-1125)
gamma propagation near interface with ground, 17: 6955 (RM-3399-PR)
ionization rate of, behind shock waves, 17: 6773 (AFCRL-62-751)
oxidation of magnesium by, 17: 6577
oxidative effects on reactor fuels (liquid), 17: 7606(R) (ORNL-1515)
plasma of, interactions with magnetic fields, 17: 7491
shock waves in, boundary layers and sheath potentials of, 17: 6899
transport properties, 17: 6806 (UCRL-7052)
AIRCRAFT REACTOR CRITICAL EXPERIMENTS
design proposal for PWAC, at CANEL, 17: 7566 (PWAC-170)
AIRCRAFT REACTOR EXPERIMENT
design and operation, 17: 7606(R) (ORNL-1515)
AIRCRAFT REACTORS
control system analysis for circulating-fuel, 17: 7570 (PWAC-206)
design and development of fluid- and solid-fuel, 17: 7565(R) (PWAC-161)
design of circulating-fuel reflector-moderated, 17: 7568 (PWAC-189 (Vol.I))
design of circulating-fuel reflector-moderated, 17: 7569 (PWAC-189 (Vol.2))
design study of core-moderated circulating-fuel, 17: 7567 (PWAC-186)
ALANINE
analysis for carbon-14 by continuous scintillation counting, 17: 5709
radiation effects on reactions with hydroxyl radical in ferri- and ferrocyanide solutions, 17: 6165
radiolysis of, electron spin resonance of free radicals produced by, 17: 5692
ALANINE, PHENYL-
analysis for carbon-14 by continuous scintillation counting, 17: 5709
ALASKA
bioenvironmental features, 17: 6273 (TID-17226)
ALBUMINS
radiation effects on synthesis in liver, 17: 5928
ALCOHOLS
alcohol-diethyl ether-ketone, effects of composition on chromatographic separation of rare earths, 17: 6009
ALKALI METALS
corrosion and mass transfer of liquid, 17: 6557
pyrophoricity, 17: 6693(T) (AEC-tr-5544)
ALKALINE EARTH METALS
determination using carbon-14 labeled oxalic acid and liquid scintillation, 17: 5992
pyrophoricity, 17: 6693(T) (AEC-tr-5544)
ALKANES
determination in kerosene by vapor-phase chromatography, 17: 6195
ALLOYS
analysis by spectroscopy of x rays produced by beta particles, 17: 5982(T) (CEA-tr-X-461)
analysis for hydrogen by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
analysis for nitrogen by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
analysis for oxygen by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
bibliography, 17: 6518 (NP-12288)
dispersion-strengthened, bibliography on, 17: 6677 (RISO-48)
high-strength, bibliography on, 17: 6521 (NP-12417)
ALPHA BEAMS
production of spill, in spiral ridge cyclotron, 17: 7356
ALPHA DECAY
spectra from, for medium-heavy nuclei, 17: 7199
ALPHA PARTICLES
biological effects of extremely energetic, 17: 5770 (MDC-TDR-62-3)
detection and measurement of, design of monitor for, 17: 6433 (HW-71354)
detection and measurement of, scintillation counter for, 17: 6434 (HW-73155)
detection and measurement in air, compensation for natural interferences in, 17: 6439 (UCRL-5979)
detection of, efficiency of semiconductor detectors for, 17: 7119 (NP-12330(p.202-8))
emission in fast fission, 17: 7097 (NP-12330(p.71-8))
reactions (α,γ) on magnesium-24, energy levels from, 17: 7262
reactions (α,t) with fluorine-19 at 18.5 Mev, 17: 7224
reactions in aluminum at 38 Mev, effect on dislocation loops, 17: 6765
scattering by thin films, energy-loss spectra from, 17: 7157
spectra from neutron reactions at high energies, 17: 7094 (NP-12330 (p.46-52))
ALUMINUM
bonding to nickel-plated uranium by pressure, 17: 6606
corrosion by steam at high-pressures and -temperatures, 17: 6580
corrosion of, by water, 17: 5656(R) (KR-29)
corrosion of, by water, formation and growth of alpha alumina monohydrate in, 17: 6573 (TID-15280)
determination in beryllium, neutron activation, 17: 6027
determination in fluorides by titration with EDTA, use of vanadyl ion as back-titrant in, 17: 5995
determination in zirconium alloys, 17: 6020
dislocation loops in alpha-particle bombarded, 17: 6765
in-pile corrosion, 17: 6565(R) (EURAEC-413)
neutron capture cross sections, fast, 17: 7606(R) (ORNL-1515)
neutron reactions in, alpha, neutron, and proton spectra from, 17: 7093 (NP-12330(p.39-45))
neutron scattering at 84 Mev, experimental and theoretical data on, 17: 7266
neutron total cross sections at 14 Mev, 17: 7095 (NP-12330(p.61-5))
nitrogen nucleus reactions at 27.5 Mev, 17: 7252
properties as tissue heterogeneity compensator in high-energy radiotherapy, 17: 5680
proton reactions (p,d), (p,π), (p,K), (p,n), and (p,t) at 30 Bev, 17: 7259
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
radiography of thin, techniques for, 17: 5980 (TID-15512)
range of neon-22 ions in, at 1 to 3 Mev, 17: 7231
reactions with uranium(III) chloride in alkali metal bromides or chlorides, 17: 6037 (HW-SA-2537)
stress attenuation in, 17: 7555(R) (HW-74761(p.11.1-14))
swelling in alpha-irradiated, 17: 6761
temperature effects on mechanical properties of, cryogenic, 17: 6542
thermal conductivity of radiator fins of, 17: 6673 (ORNL-2065)
ALUMINUM ALLOYS
corrosion, 17: 6572 (OTS-61-31480)
end milling of U-500, 17: 6614
swelling in alpha-irradiated, 17: 6761
thermophysical properties of, 17: 6549
Al–Ag, dilocation reactions in intermetallic precipitates of, 17: 6687 (UCRL-10124)
Al–Ag, yield strength of intermetallic, temperature effects on, 17: 6685 (UCRL-9992)
Al–Cr–Y, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)
Al–Cu, strain fields in, 17: 6591 (ASD-TDR-62-734)
Al–Cu, thermal conductivity, 17: 6673 (ORNL-2065)
Al–Fe–Ni, corrosion of, by water above 315°C, 17: 7552(R) (HW-74761 (p.8.1-15))
Al–Fe–U, phase studies, 17: 6727
Al–Hf, phase studies, 17: 6729
Al–Mg, analysis of, for antimony, 17: 5960 (PG-Report-337)
Al–Mg, analysis of, for cobalt, 17: 5960 (PG-Report-337)
Al–Mo, phase studies, 17: 6729
Al–Nb–Ti, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)
Al–Nb–Zr, phase studies, 17: 6729
Al–Nb–Zr, preparation, 17: 6652(R) (DRI-2057)
Al–Pu, critical mass studies, 17: 7549(R) (HW-74761(p.5.1-35))
Al–Pu, properties, 17: 6512 (CRRM-1111)
Al–Pu, radiation effects, 17: 6512 (CRRM-1111)
Al–Ti, elastic properties, 17: 6709
Al–Ti, phase studies, 17: 6729
Al–Ti–V, stress-corrosion, 17: 6569(R) (NP-12369)
Al–Zr, phase studies, 17: 6729
ALUMINUM CITRATES

protective effects against strontium-90 absorption in mice, 17: 5744
ALUMINUM COMPACTS
creep-rupture of sintered effects of high temperature on, 17: 6511(R) (BMI-1593(Del.))
development of sintered, 17: 7609(R) (SRO-75)
ALUMINUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
ALUMINUM ISOTOPES Al-27
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
neutron reactions (n,α) on, yields from epithermal and fast, 17: 7306
proton reactions at 57 Mev on, proton distributions from, 17: 7197
proton reactions (p,α) and (p,γ) on, energy levels from, 17: 7262
proton reactions (p,α) on, distributions from, 17: 7168
proton reactions (p,γ), resonance energies and half width for, 17: 7173
proton reactions (p,3pn), at high energies, recoil study of, 17: 7230
scattering of helium-3 particles by, 17: 6957 (TID-17357(Pt.I))
ALUMINUM OXIDE COATINGS
deposition on sodium iodide crystals, 17: 6491(P)
for tungsten alloy, glass-impregnated, 17: 6563 (DC-61-7-6)
ALUMINUM OXIDE FILMS
preparation of thin, 17: 5945
ALUMINUM OXIDES
flow characteristics of, high-temperature, 17: 6554
particle scattering by, energy-loss spectra from, 17: 7157
Al_2O_3–Fe_2O_3–TiO_2, emissivity, 17: 6675(R) (PWA-2128)
Al_2O_3–TiO_2, total hemispherical emittance at high temperatures, 17: 6731
Al_2O_3–UO_2, effects of thermal neutron irradiation on, 17: 6755
ALUMINUM SYSTEMS
Al–Si, activation analysis for phosphorus in hypereutectic, 17: 5994
Al–Si–Zr, phase studies, 17: 6729
AMERICIUM
separation from chloride solutions by solvent extraction using mono-2-ethyl hexyl phosphoric acid, synergistic effects in, 17: 6188 (TID-15271)
separation from nitrate solutions by ion exchange, comparison with other actinides, 17: 6182 (IA-783)
AMERICIUM ISOTOPES Am-241
alpha particle–gamma ray angular correlations in, 17: 7219
AMERICIUM ISOTOPES Am-243
alpha particle–gamma ray angular correlations in, 17: 7219
AMINE COMPLEXES
salicylaldehyde-triethylene cobalt chloride, radiation damage annealing in, 17: 7135 (NP-12330(p.422-8))
AMINES
solvent properties for nitric acid, 17: 5656(R) (KR-29)
AMINO ACIDS
analysis for carbon-14 and tritium by continuous scintillation counting, 17: 5709
AMMONIA
mass spectra of volatile, 17: 6791 (IS-424)
radiolysis of, formation of hydrazine by, 17: 6125 (BNL-6016)
reactions with cerium, 17: 6100
scavenging effects on radioinduced polymerization of cyclopentadiene at −78°C, 17: 6149
AMMONIUM CHLORIDE CRYSTALS
elastic constants of, 17: 6801(R) (TID-17303)
AMMONIUM CHLORIDES
cetyl-dimethyl-benzyl-, solvent properties for uranium in carbonate solutions, 17: 6198
AMMONIUM COMPOUNDS, QUATERNARY
spectra of irradiated, electron spin resonance, 17: 6034 (BNL-5559)
AMMONIUM FLUOBERYLLATES
analysis for ammonium ions and free acid, 17: 6017
AMMONIUM IONS
determination in ammonium fluoberyllate, 17: 6017
determination in water, colorimetric, 17: 5977 (TID-15070)
AMMONIUM URANATES
analysis of, for uranium, 17: 5957 (PG-Report-294)
precipitation from uranyl nitrate solutions, 17: 5935 (CEA-2204)
AMPLIFIERS
design of fast-pulse, 17: 6389 (CERN-62-32)
design of hydraulic, 17: 6381 (AD-254402)
design of linear, for nuclear instrumentation, 17: 6381 (AD-254402)
ANALGESICS
effects of radiation on response of rats to, whole-body exposure, 17: 5788
ANALYSIS
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
ANEMIA
therapy using bone marrow transfusions in man, 17: 5921
ANIMAL CELLS
radiation effects, influence of age and dose, 17: 6330
radiation effects on cancerous, 17: 5824
radiation injury in tissue culture, chemical protection, 17: 5922
radiation injury kinetics in cell, 17: 5876
radioinduced chromosome aberrations, effects on viability, 17: 5890
radiosensitivity of HeLa cells in culture, 17: 5674(R) (LAMS-2780 (p.211-45))
ANIMAL REPRODUCTION
effects of chronic ingestion of strontium-90 on, in miniature swine, 17: 5700 (HW-74969)
ANIMALS
calcium and strontium metabolism in, bibliography on, 17: 5747
radiation effects on bone marrow and tissue transplants in, 17: 5814
radiation injuries in, therapy using bone marrow transplantation, 17: 5920
ANION EXCHANGE MATERIALS
development of scintillating, 17: 5940(R) (TID-15720)
ANOXIA
protective effects against radiation injury in *Staphylococcus aureus*, 17: 5771 (TID-13275)
protective effects against radiation injury of intestine, induction by intra-arterial catheterization, 17: 5667 (BNL-5798)
ANP REACTORS
shielding weights for circulating fuel reflector-moderated, estimation of, 17: 7564 (PWAC-89)
ANTHRACENE CRYSTALS
performance for continuous scintillation counting of carbon-14 and tritium, 17: 5709
ANTIBIOTIC THERAPY
effectiveness in radiation sickness, 17: 5911(T) (IPRS-16471)
effectiveness in treatment of radiation injuries in mice, 17: 5917
ANTIGENS
antibody response in reticuloendothelial system, tracer study, 17: 5724
characteristics of synthetic polypeptides as, 17: 5762(R) (AD-276039)
extraction from tissues, 17: 5762(R) (AD-276039)
preparation of labeled, 17: 5724
radiation effects on anaphylactic reactions in guinea pigs, 17: 5783
ANTIMONY
determination in niobium, tantalum, and tungsten, spectrometric, 17: 6022
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination of, in aluminum-magnesium alloys, 17: 5960 (PG-Report-337)
determination of, in magnesium-manganese alloys, 17: 5960 (PG-Report-337)
ANTIMONY ALLOYS
Sb–In, pinch effect in electron-hole plasma in, 17: 7479
Sb–Mn, pyrophoricity, 17: 6693(T) (AEC-tr-5544)
Sb–Zr, corrosion by water at 680°F, 17: 6561(R) (ARF-2198-34)
Sb–Zr, strength, 17: 6561(R) (ARF-2198-34)
ANTIMONY HYDRIDES
mass spectra of volatile, 17: 6791 (IS-424)
ANTIMONY ISOTOPES Sb-121
nuclear quadrupole resonance lines of, in antimony trichloride, relative intensities of, 17: 7299
ANTIMONY ISOTOPES Sb-122
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
ANTIMONY ISOTOPES Sb-124
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
gamma emission of, 17: 7116 (NP-12330(p.186-92))
gamma specific emission coefficient, 17: 6431 (CEA-2036)
ANTIMONY ISOTOPES Sb-126

decay, 17: 7139 (TID-14799)
ANTIMONY ISOTOPES Sb-127
decay, 17: 7139 (TID-14799)
ANTIMONY ISOTOPES Sb-128
decay, 17: 7139 (TID-14799)
ANTIMONY ISOTOPES Sb-129
decay, 17: 7139 (TID-14799)
ANTIMONY ISOTOPES Sb-130
decay, 17: 7139 (TID-14799)
ANTIPROTONS
annihilation interactions with protons, meson production in, 17: 6947 (IA-768)
interactions with protons, meson (π)-nucleon anti-isobar-isobar pair production, 17: 7002
interactions with mesons (π^+), $\bar{N}_3^+$ anti-isobar production in, 17: 7002
interactions with protons at 0.5 to 1.0 Bev, cross sections for, 17: 6959 (UCRL-9288(Rev.))
interactions with protons, one-pion-exchange contributions to, 17: 6980
APATITES
precipitation of calcium-substituted, 17: 6061
ARGON
electric discharge in, magnetic field effects on light characteristics of pulsed, 17: 7486
electron drift velocities in, 17: 7018
positronium decay rates in, ortho-, 17: 6882
scattering from cleavage plane of lithium fluoride, molecular, 17: 6835
scattering from lithium fluoride cleavage plane, 17: 6794 (K-1498)
total ionization cross sections, 17: 6805 (UCRL-6702)
ARGON IONS
electron ejection from a clean surface of molybdenum by, 17: 6855
reactions with copper, gold, and graphite at 100 to 30,000 ev, yields of secondary ions from, 17: 7268
ARGON ISOTOPES
occurrence of, in meteorites, minerals, and rocks; bibliography on, 17: 6270(R) (NYO-10325)
ARGON ISOTOPES Ar-37
electron-capture radiative decay scheme, 1S, 17: 7158
ARGON ISOTOPES Ar-40
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
proton reactions (p,γ) at 8.9 Mev, energy levels from, 17: 7177
scattering by thin films, energy-loss spectra from, 17: 7157
ARGONAUT REACTOR
use for neutron activation analysis, 17: 6030
ARGONNE RESEARCH REACTOR
radiation target can operation, 17: 7630 (ANL-6554)
ARGUS OPERATION
electron injection into radiation belts, 17: 6839
ARMY REACTORS (ML-1)
hazards summary, 17: 7603 (IDO-28560(Vol.I))
hazards summary supplement for, 17: 7604 (IDO-28560(Vol.II))
ARMY REACTORS (PM-3)
safety hazards of operation in Antarctica, evaluation of, 17: 7605 (MND-M3A-2496-II(Add.))
ARSENIC HYDRIDES
mass spectra of volatile, 17: 6791 (IS-424)
ARSENIC ISOTOPES As-72
dosimetry of injected, 17: 5735
ASTATINE ISOTOPES At-207
formation in proton reactions with bismuth and lead at high energies, 17: 7276
ASTATINE ISOTOPES At-209
formation in proton reactions with bismuth and lead at high energies, 17: 7276
ASTROPHYSICS
prestellar state of matter, 17: 6916
radio emission by Jupiter, origin of decameter, 17: 6912
ATMOSPHERE
analysis for radioactive particles by filtration and autoradiography, 17: 6792(R) (ISS 62/14)
analysis of, for fluorine, 17: 5959 (PG-Report-329)
contamination by cesium-137, iodine-131, and strontium-89 and -90, maximum permissible levels for, 17: 6331
electron diffusion in, Van Allen, 17: 6941
fallout diffusion and dispersion in, 17: 6285
monitoring system intercalibration, 17: 5753 (NRL-5850)
radiation monitoring of, in region of Los Angeles, 17: 6253 (CEX-59.4.16)
radioactivity in Portugal after the Sahara atomic explosions, 17: 6355
radioactivity of, in nuclear reactor environment, 17: 6290
radioisotope levels in, 17: 5751(R) (HASL-132)
radon content of, weather effects on, 17: 6286
sampling for iodine isotopes in, 17: 5754 (PG-Report-408)
ATOMIC CLOUDS
formation, stable and dynamic cloud models, 17: 6307 (CDRP-182-112)
ATOMIC ENERGY
bibliography of bibliographies, 10–11/62, 17: 5657 (TID-3714)
civil liability in, European Convention on, 17: 6328
developments in peaceful applications, 1962 review, 17: 5662
financial liabilities in, summary of German regulations on, 17: 6329
ATOMIC ENERGY OF CANADA LTD. CHALK RIVER PROJECT, CHALK RIVER, ONT.
water monitoring program at, off-site, 17: 6334
ATOMIC EXPLOSIONS
detection of, conference on, 17: 6265 (NP-12297)
effects of high-altitude, 17: 6296
effects on plant ecology in Nevada Proving Grounds Area, 17: 5655 (HW-SA-2546)
effects on the ionosphere, 17: 6847
fusion of fission products in, to form platinum-group elements, 17: 7242
gas sampling of Tamalpais, 17: 5937 (ORNL-TM-445)
geomagnetic effects of high-altitude, 17: 6283
ionospheric effects of high-altitude, 17: 6278
radiation effects on bone marrow, 17: 5785
seismic measurements of DANNY BOY, 17: 6268 (NP-12419)
seismic measurements of Hyrax, 17: 6269 (NP-12420)
seismic signals from Fisher, long-range measurements of, 17: 6259 (NP-12279)
seismic signals from Small Boy, long-range measurements of, 17: 6260 (NP-12280)
seismic signals from Sedan, long-range measurements of, 17: 6261 (NP-12281)
seismic signals from Merrimac, long-range measurements of, 17: 6262 (NP-12282)
seismic signals from Agouti, long-range measurements, 17: 6263 (NP-12283)
seismic signals from Antler, long-range measurements, 17: 6264 (NP-12284)
seismic signals from Chinchilla, long-range measurements of, 17: 6266 (NP-12298)
strontium-90 content in fallout after French, 17: 6272(R) (ORO-520)
ATOMIC MASSES
table of, based on carbon-12, 17: 6072
ATOMIC PHYSICS
nuclear relaxation as a probe of electron spin correlation, 17: 6856
ATOMIC STRUCTURE
of 4f rare earths and plutonium, 17: 6701
research studies, 1962, 17: 5662
ATOMS
distortion of, Hartree-Fock equations for systems with, 17: 6799 (TID-14708)
electron collisional excitation in stellar atmosphere, 17: 6905
electron scattering by, effects of negative-ion states on theory of, 17: 7076 (BNL-5801)
interactions with atoms and heavy particles, theory of, 17: 6774 (AFCRL-531(I))
nuclear relaxation as a probe of electron spin correlation, 17: 6856
photoelectron emission by, cross sections for K-shell, 17: 6851
spectra of, effects of Coulomb interactions on energy distribution of terms and line arrays in, 17: 6798 (RM-2947-AEC)
susceptibility of, calculation of self-diamagnetic, 17: 6828
ATROPINE
preparation of tritium labeled, at high specific activity, 17: 6138
AUDITORY ORGANS
radiation effects on, from head and neck therapy, 17: 5896

radiation effects on, gamma, 17: 5834
radiotherapy of parotid gland, effects on cerebral and cranial bones, 17: 5849
AUSTRALIA
uranium exploration in South Alligator Area of, 17: 6277
AUSTRIA
fallout monitoring, 1961, 17: 6346
AZO DYES
complexing of arsenazo III with metals, mechanism of, 17: 6007

B

BACTERIA
antibiotic resistance of *Chondrococcus columnaris*, 17: 5769 (HW-SA-2540)
electronic counting procedure, 17: 5674(R) (LAMS-2780(p.211-45))
growth of, in Canada-India Reactor cooling water, 17: 6587
metabolism of oxygen by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
radioinduced mutations in *Chondrococcus columnaris*, 17: 5769 (HW-SA-2540)
radiosensitivity of *Staphylococcus aureus*, effects of glycerol and anoxia, 17: 5771 (TID-13275)
radiosensitivity of lysine decarboxylase in *Bacterium cadaveris*, 17: 5829
BACTERIOPHAGES
molecular structure of alpha DNA, 17: 6792(R) (ISS 62/14)
morphology of *anti-Brucella*, 17: 6792(R) (ISS 62/14)
mutation of *B. subtilis*, 17: 6792(R) (ISS 62/14)
radiosensitivity, 17: 6792(R) (ISS 62/14)
BALANCES
design of, for measurement of magnetic susceptibilities, 17: 6385 (CEA-2187)
BARIUM
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
BARIUM CARBIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)
BARIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
with uranyl acetate in aqueous solution, spectra of, 17: 6081
BARIUM ISOTOPES
occurrence of, in environment, 17: 5755 (UCLA-497)
BARIUM ISOTOPES Ba-123
half life, 17: 7194
BARIUM ISOTOPES Ba-125
half life, 17: 7194
BARIUM ISOTOPES Ba-126
half life, 17: 7194
BARIUM ISOTOPES Ba-127
half life, 17: 7194
BARIUM ISOTOPES Ba-133
metabolism in rats and mice, 17: 5670(R) (LAMS-2780(p.17-84))
BARIUM ISOTOPES Ba-137
preparation in organic solvent, 17: 6373
BARIUM ISOTOPES Ba-140
content in milk, effects of pasture and stored feed consumption by cows on, 17: 6356
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
BARIUM NITRATES
transfer between heavy and light water, ionic hydration in, 17: 6096
BARIUM TITANATES
emissivity, 17: 6675(R) (PWA-2128)
neutron-diffraction analysis of, 17: 6647 (BNL-5747)
BARLEY
radiosensitivity and cytological changes in, effects of variety on, 17: 5903
BENZENE
reactions with hydrogen atoms, 17: 6145
solvent properties for boron in beryllium oxide, 17: 6015
BENZENE, ETHYNYL-
polymerization, 17: 6117(T) (SCL-T-446)
BENZENE, NITRO-
solvent properties for cesium, 17: 6194
spectra in gamma irradiated organic glasses at −196°C, 17: 6148
BENZENE, TRIMETHOXY-
hydrogen exchange, deuterium isotope effect in acid-catalyzed, 17: 6121
BENZENEARSONIC ACID
solvent properties for niobium and tantalum, 17: 6022
BENZENES
protective effects against x radiation in yeast cells, 17: 5919
BENZENES, FLUOROHALO-
spectra of, NMR, 17: 7124 (NP-12330(p.242-8))
1,3,5-BENZENETRIAMINE, 2,4,6-TRINITRO-
crystal structure, 17: 6116 (TID-14533)
BENZOPHENONE, 2-HYDROXY-
chelates with rare earths, emission spectra, 17: 6085
BENZOPHENONES
photochemical reduction by 2-propanol, inhibition by disulfides and thiols, 17: 6146
spectra in gamma irradiated organic glasses at −196°C, 17: 6148
BERYLLIUM
analysis of, neutron activation, 17: 6027
bibliography on, 17: 6521 (NP-12417)
brazing and welding, 17: 6558
brazing, for high-temperature applications, 17: 6607
brazing of thin windows to supports, 17: 6605
coating of, with chromium, 17: 7592(P)
corrosion by liquid sodium, 17: 7565(R) (PWAC-161)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
corrosion by steam at 650°C, 17: 6568(R) (NMI-1905)
corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
determination in zirconium alloys, 17: 6020
determination using sodium or sulfosalicylate, titrimetric, 17: 6011
drilling, 17: 6618
electron pair wave functions for atom, 17: 6842
fabrication of finned tubular, 17: 6599 (TID-17340)
helium nucleus (helium-3) scattering at 31 Mev, elastic, 17: 7148 (UCRL-9996)
joining, 17: 6628
lathe turning, 17: 6620
neutron capture cross sections, fast, 17: 7606(R) (ORNL-1515)
neutron diffusion equilibrium in crystalline, thermal, 17: 7129 (NP-12330 (p.378-83))
neutron scattering at 84 Mev, experimental and theoretical data on, 17: 7266
photoelectric K-absorption cross section of, 17: 6870
plastic behavior of, electron microscopy studies of, 17: 6641 (AWRE-O-59/62)
proton reactions (p,d), (p,π), (p,K), (p,n), and (p,t) at 30 Bev, 17: 7259
tensile properties, 17: 7565(R) (PWAC-161)
tensile properties of, effects of machining and grinding on, 17: 6642 (AWRE-O-63/62)
BERYLLIUM ALLOYS
thermophysical properties of, 17: 6549
Be–Co, corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
Be–Cr, corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
Be–Cu, structural hardening in, 17: 6710
Be–Nb, oxidation, 17: 6564(R) (DRI-2056)
Be–Nb, oxidation, 17: 6653(R) (DRI-2071)
Be–Nb, oxidation, 17: 6643(R) (BBC-112)
Be–Ni, corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
Be–Zr, oxidation, 17: 6564(R) (DRI-2056)
Be–Zr, oxidation, 17: 6643(R) (BBC-112)
Be–Zr, oxidation, 17: 6653(R) (DRI-2071)
BERYLLIUM COMPACTS
Be–BeO, corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
BERYLLIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
BERYLLIUM FLUORIDES
BeF_2–LiF–ThF_4–UF_4–ZrF_4, phase studies, 17: 7562(R) (ORNL-3369)
BeF_2–LiF–ThF_4, phase studies at high temperatures, 17: 7606(R)

(ORNL-1515)
BeF_2–LiF–ZrF_4, phase studies of, 17: 7562(R) (ORNL-3369)
BERYLLIUM ISOTOPES Be-7
deposition in north temperate latitudes of cosmic-ray produced, 17: 6840
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
energy levels of, low-lying, 17: 7200
BERYLLIUM ISOTOPES Be-8
decay, 2-alpha, 17: 7261
energy levels from lithium-7 (p,α) reactions, 17: 7179
BERYLLIUM ISOTOPES Be-9
deuteron reactions (d,p) at 13.8 Mev, proton polarization from, 17: 7286
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
gamma reactions (γ,d), mechanisms in, 17: 7185
neutron reactions (n,p) on, cross sections for, 17: 7198
proton reactions (p,n) at 2.4 to 4.1 Mev, neutron angular distributions and polarization from, 17: 7246
BERYLLIUM ISOTOPES Be-10
deuteron reactions (d,p) at 13.8 Mev, proton polarization from, 17: 7286
BERYLLIUM OXIDE COMPACTS
Be–BeO, corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
BERYLLIUM OXIDES
analysis for boron by solvent extraction using benzene, photometric, 17: 6015
compressive creep of polycrystalline, 17: 6684 (UCRL-6748)
corrosion by potassium–sodium alloys and sodium at high temperatures, 17: 7606(R) (ORNL-1515)
flow characteristics of, high-temperature, 17: 6554
neutron inelastic scattering by polycrystalline, cold, 17: 7130 (NP-12330 (p.384-91))
oxygen diffusion in polycrystalline, 17: 6666 (NAA-SR-7637)
radiation effects on, neutron, 17: 6734 (AAEC/E-99)
radiation effects on properties, 17: 6741(R) (GEMP-18A)
sealing of, to refractory metals, 17: 6676(R) (RADC-TDR-62-401)
spectra at 90 and 320°K, cathodoluminescence, 17: 6089
BeO–U, neutron multiplication in, 17: 7131 (NP-12330(p.392-8))
BeO–UO_2, effects of thermal neutron irradiation on, 17: 6755
BETA DECAY
bremsstrahlung accompanying, emission of double and single internal, 17: 7152
calculational procedures for first-forbidden, 17: 7106 (NP-12330 (p.132-6))
BETA PARTICLES
biological effects from internally-deposited tritium on growth of HeLa cells in culture, 17: 5773 (TID-13613)
detection and measurement of, design of monitor for, 17: 6433 (HW-71354)
detection of, 4π plastic scintillation counter for, 17: 6459
determination of, in sulfur disc neutron dosimeter due to phosphorus-32, 17: 5969 (PG-Report-387)
lethal effects from tritium incorporated in *Escherichia coli*, 17: 5793
measurement of, from tantalum-182 in neutron dosimeter, 17: 5958 (PG-Report-306)
measurement of, in marine material, 17: 5972 (PG-Report-403)
BETA SOURCES
preparation of colloidal, for medical purposes, 17: 5656(R) (KR-29)
properties of yttrium-90 needles, 17: 5695
BETA SPECTROMETERS
design and development, 17: 5692
design of, for (e–e) and (e–e*) scattering analysis, 17: 7117 (NP-12330 (p.193-8))
resolution of magnetic, effects of field errors on, 17: 6436 (IS-476)
BETA SPECTROSCOPY
uses of, 17: 5692
BEVATRON
injector design for, 17: 7309 (BNL-6511(p.1-6))
BIBLIOGRAPHIES
Defense Metals Information Center accessions, 17: 6521 (NP-12417)
on alloys, metals, and refractory materials, 17: 6518 (NP-12288)
on analytical chemistry of niobium and tantalum, 17: 6022
on analytical chemistry of rare earths, 17: 6024
on argon isotope occurrence in meteorites, minerals, and rocks, 17: 6270(R) (NYO-10325)
on bibliographies of atomic energy literature, 10–11/62, 17: 5657 (TID-3714)
on calcium and strontium metabolism in animals and man, 17: 5747
on calcium isotope occurrence in meteorites, minerals, and rocks, 17: 6270(R) (NYO-10325)
on corrosion products in high-temperature water systems, 17: 6578
on dispersion-strengthened materials, 17: 6677 (RISO-48)
on electronic equipment in nuclear physics, 17: 6426
on geothermal models and theories, 17: 6294
on hafnium and zirconium analytical chemistry, 17: 6020
on monitoring fuel element integrity, 17: 7583
on plastics toxicity, 17: 6318 (PLASTEC-NOTE-5)
on quantitative inorganic analysis, 17: 6006
on radiation effects on plants, 17: 5905
on radiation effects on metals and high-melting materials, 17: 6768
on scandium and yttrium chemistry, 17: 6019
on solvent extraction of inorganic species, 17: 6179 (IA-740)
on sputtering of solids, 17: 6813(T) (NP-tr-930)
on strontium isotope occurrence in meteorites, minerals, and rocks, 17: 6270(R) (NYO-10325)
on thorium, analytical chemistry, 17: 6021
on tritium quantitative determination, 17: 6035 (DP-511)
on urine analysis for radioisotopes, 17: 5981 (VDIT-66)
on zirconium salts in aqueous solutions and zirconyl theory, 17: 6097
BINDING ENERGY
calculation of constants in the Weizsacker formula for, with account for correlations, 17: 7284
of nuclear matter, effect of three-body clusters on, 17: 7215
BIOCHEMISTRY
fuel cells based on, use for spacecraft environmental control and power, 17: 5663
BIOLOGICAL MATERIALS
age determination of, using radiocarbon method, 17: 6295
age determination of, using radiocarbon method, 17: 6298
age determination of, using radiocarbon method, 17: 6299
analysis for chloride by isotope dilution, 17: 5999
radiation effects of fast neutrons on, 17: 6315 (ORNL-1559)
BIOLOGICAL SYSTEMS
tracer studies on metabolism, evaluation of kinetic data, 17: 5726
BIOLOGICAL WARFARE AGENTS
food contamination, 17: 6339
BIOMETRY
calculation of relation between effect and oxygen concentration in irradiated chromosomes, 17: 5833
formulation of equation to describe kinetics of two-bit chromosome exchanges, 17: 5690
kinetics of radiation injury in cell populations, mathematical analysis, 17: 5876
BIOPHYSICS
of communications, research programs on, 17: 6801(R) (TID-17303)
BIPHENYL
spectra in gamma irradiated organic glasses at −196°C, 17: 6148
BISMUTH
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination in niobium, tantalum, and tungsten, spectrometric, 17: 6022
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)
electric conductivity of wire at low temperatures, effects of high magnetic fields, 17: 6424
helium nucleus (helium-3) scattering at 31 Mev, elastic, 17: 7148 (UCRL-9996)
light absorption by vaporous, relations with thermodynamic properties, 17: 6802 (TID-17348)
photoelectron distribution from, gamma energy dependence of, 17: 6833
proton reactions at high energies, formation of astatine-207 and -209 in, 17: 7276
BISMUTH ALLOYS
Bi–Ag, coprecipitation of radioactive tracers in, 17: 6683 (UCRL-6452 (Pt.II))
Bi–Au, coprecipitation of radioactive tracers in, 17: 6683 (UCRL-6452

(Pt.II))
Bi–Cu, coprecipitation of radioactive tracers in, 17: 6683 (UCRL-6452 (Pt.II))
Bi–U, light absorption by vaporous, relations with thermodynamic properties, 17: 6802 (TID-17348)
Bi–U, thermodynamics, 17: 6106
BISMUTH FILMS
thermoelectric power of thin, 17: 6700(T) (UCRL-Trans-892(L))
BISMUTH ISOTOPES Bi-209
fission of, by protons at 600 Mev, 17: 7086 (NP-12319)
gamma reactions (γ,p), proton distribution from, 17: 7092 (NP-12330 (p.35-8))
proton reactions at 57 Mev on, proton distributions from, 17: 7197
BISMUTH ISOTOPES Bi-210
separation from lead-210 and polonium-210 in nitric and perchloric acids, electrophoretic, 17: 6153
BISMUTH SYSTEMS
Bi–Ge–Te, properties as thermocouple, 17: 7642(R) (AD-276092)
Bi–Pb–Te, properties as thermocouple, 17: 7642(R) (AD-276092)
Bi–Te, radiation effects on electrical properties of, 17: 6441 (USNRDL-TR-581)
BLADDER
radiation damage to, from therapy of uterine cervix carcinomas, 17: 5815
radiation injury of urinary, following radium therapy of carcinoma of the cervix, 17: 5787
radiotherapy of, hemorrhage from megavoltage, 17: 5805
BLOOD
analysis for sodium-24, gamma spectrometric, 17: 5968 (PG-Report-385)
decomposition by dry ashing, retention of tracers in, 17: 5716
extracorporeal irradiation in therapy of leukemia, 17: 5847
radiation effects on luminescence of, in rats, 17: 5852
BLOOD CELLS
radiation effects on biological and structural properties of, *in vitro*, 17: 5862
BLOOD CIRCULATION
in carotid arteries in dogs, tracer study using double collimator, 17: 5732
in cerebrum, tracer method for measurement, 17: 5711
BLOOD COAGULATION
disorders following gynecologic radium treatment, 17: 5818
BLOOD DISEASES
case histories in early radiologists, 17: 5804
BLOOD PICTURE
radiation effects in man–high-level whole-body exposure, 17: 5874
radiation effects on morphology of granulocytes, whole-body exposure, 17: 5797
radiation effects on morphology of granulocytes, whole-body exposure, 17: 5798
radiation effects on peripheral, luminescence, 17: 5823
radiotherapy effects on peripheral, malignant neoplasm, 17: 5850
BLOOD PLASMA
radiation effects on iron content in, in rabbits, 17: 5826
BLOOD PRESSURE
radiation effects on, 17: 5844
BLOOD SERUM
albumin content during radiation sickness, 17: 5928
BLOOD TRANSFUSIONS
therapeutic effectiveness in radiation sickness, 17: 5925
BLOOD VESSELS
circulation in carotid, tracer study in dogs using double collimator, 17: 5732
radioinduced hypertensive damage in, 17: 5844
BLOOD VOLUME
tracer studies using iodine-131, 17: 5673(R) (LAMS-2780(p.181-210))
BODY FLUIDS
analysis for urea, 17: 6032(P)
analysis of fetal, for calcium, strontium, and other minerals, 17: 5731
BOILERS
description of Dragon, 17: 7617
gas removal from, non-condensable, 17: 6225(P)
specific gravity of steam-water mixture in, 17: 6378
BOILING
bubble growth in, dynamics of, 17: 6235
burnout heat transfer in saturated pool, effects of parameters, 17: 6241
film, heat transfer from horizontal surface, 17: 6240
BOILING REACTORS
containment, comparison of methods, 17: 7626
design and development, 17: 7601(R) (GNEC-254)
dynamic behavior of, analysis of, 17: 5656(R) (KR-29)
fuel burnup characteristics in pressurized, ceramic, 17: 6755
hydrodynamic instabilities in, effects on power output, 17: 7539(R) (EURAEC-384)
BONDS
testing of ceramic coating-metal, development of nondestructive methods for, 17: 6509(R) (AFR-1213-5)
BONE FRACTURES
mineral metabolism in, tracer study, 17: 5678
BONE MARROW
effects of injected extracts on liver regeneration in normal and irradiated rats, 17: 5854
radiation effects on active and passive immunity to transplantation of, in mice, 17: 5916
radiation effects in mice and hamsters, effects of physiological and genetic factors, 17: 5779(R) (UCSF-22)
radiation effects on, in atomic bomb survivors, 17: 5785
radiation effects, chemical protection, 17: 5831
radiation effects on luminescence of, in rats, 17: 5852
radiation effects on, 17: 5854
transfusions of, effects on anemia, cancer, leukemia, and radiation injuries in man, 17: 5921
transplantation in irradiated mice and men, 17: 5683
transplantation of, effects on survival of irradiated animals, 17: 5920
transplantation of, effects of animal immunity on, 17: 5814
BONE TUMORS
development of, after radiotherapy of fibrous dysplasia, 17: 5866
induced by injected strontium-89, correlation with tissue distribution, 17: 5729
radioinduced after injection of strontium-90 in mice, 17: 5907
radioinduced in mice, relation of radiation dose and dose rate, 17: 5718
BONES
analysis of bovine for naturally-occurring radium-226, polonium-210, and thorium-228, 17: 5705 (TID-14604)
calcium content in epiphyseal cartilage in rat tibia, electron probe for measurement of, 17: 5727
calcium metabolism, tracer studies in man, 17: 5742
radiation effects on cerebral and cranial, after therapy of parotid gland, 17: 5849
sorption of calcium in epi- and metaphysis of, after local radiation damage, 17: 5901
strontium levels in human, 17: 5751(R) (HASL-132)
strontium metabolism, effects of dietary levels of protein, 17: 5745
strontium-90 content in human, effects of age on, 17: 5714
strontium-90 distribution in sheep, 17: 5741
strontium-90 metabolism in, in man, 17: 5715
structure of, relation of ossification and organic substratum in, 17: 6792(R) (ISS 62/14)
thorium-232, thorium-228, and radium-228 content after injection of Thorotrast, 17: 5707 (TID-15308)
BORATES
boron-11 coupling constants in, 17: 7127 (NP-12330(p.295-301))
sodium-23 coupling constants in, 17: 7127 (NP-12330(p.295-301))
BORIDES
plasma spraying of, 17: 6556
BORON
determination in aqueous solutions, extraction-flame photometric, 17: 5998
determination in beryllium oxide by solvent extraction using benzene, photometric, 17: 6015
determination in poison standards for Phoenix fuels by neutron activation, 17: 5951 (HW-74796)
determination in zirconium and zirconium alloys by direct absorptiometric method, 17: 5965 (PG-Report-362)
determination of, in zirconium and zirconium alloys, 17: 5970 (PG-Report-391)
emittance at high temperatures, total hemispherical, 17: 6731

isotope relative abundance in natural, measurements in laboratory standards, 17: 6787 (EANDC(E)-36L)
BORON CARBIDES
emittance at high temperatures, total hemispherical, 17: 6731
BC–Zircaloy-2 dispersion, remote preparation of irradiated metallographic specimens of, 17: 6526 (TID-7625(p.20-9))
BORON HYDRIDES
radiolysis of deca- and penta-, spectra of yields in, 17: 6147
synthesis of tetraborane-4-B^{10}, 17: 5944
yields in radiolysis of deca- and pentaborane, spectra of, 17: 6147
BORON ISOTOPES B-10
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
gamma reactions (γ,d), mechanisms in, 17: 7185
proton reactions at 1 to 3.5 Mev, cross sections for, 17: 7176
BORON ISOTOPES B-11
deuteron reactions (d,p), angular distributions from, 17: 7165
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
nitrogen nucleus reactions at 27.5 Mev, 17: 7252
nuclear quadrupole coupling in borates, 17: 7127 (NP-12330(p.295-301))
proton reactions (p,α) at 140 to 550 kev, angular distribution of alpha particles from, 17: 7163
proton reactions (p,d) at 17.6 to 20 Mev, 17: 7217
BORON ISOTOPES B-12
decay of, comparison of beta spectra with nitrogen-12, 17: 7141 (TID-15182)
energy levels from boron-11 (d,p) reactions, 17: 7165
BORON NITRIDES
properties of pyrolytic, 17: 6550
BORON OXIDES
spectra of vapor of, infrared, 17: 6045(R) (RAD-SR-62-251)
BORON SYSTEMS
B–Ni, diffusion of, in Ni–Ti alloys, 17: 6591 (ASD-TDR-62-734)
BOSONS
existence of χ_1 field properties and interactions of, 17: 7011
gauge invariance and correlated boson fields, 17: 6969
interactions and properties of, model for, 17: 7016
quantum cell model for, 17: 6993
quantum statistical mechanics of systems of, with several components, 17: 7511
structures of intermediate, in weak interactions, 17: 6996
BRAIN
blood circulation in, tracer method for measurement of, 17: 5711
functional injuries induced by radiation or trauma, electroencephalographic record, 17: 5886
radiation effects on lipid exposure in, whole-body exposure, 17: 5882
radiation effects on function, 17: 5888
radiation effects on electroencephalographic changes in, 17: 5902
radiation effects on spread of tick-borne encephalitis in lymphatic system in mice, 17: 5786
radiation effects on experimental encephalomyelitis in guinea pigs, 17: 5801
BRAIN TUMORS
localization by photoscanning after administration of mercury-203, 17: 5841
localization of, using small doses of intra-arterial phosphorus-32, 17: 5681
BRASS
structure of beta-, neutron scattering determination of ordered, 17: 6705
BRASS CRYSTALS
neutron diffraction by β-, thermal, 17: 7070
BRAZING
development for reactor materials, 17: 7606(R) (ORNL-1515)
of beryllium for high-temperature applications, 17: 6607
of thin beryllium windows to supports, 17: 6605
BRAZING ALLOYS
corrosion by reactor fuels and coolants, 17: 7606(R) (ORNL-1515)
properties of, for reactor materials, 17: 7606(R) (ORNL-1515)
BREASTS
tumor induction in rat, by 3-methylcholanthrene and x radiation, 17: 5839
BREEDER REACTORS
fuel value of plutonium oxide in fast, 17: 7545 (HW-72304)
BREMSSTRAHLUNG
emission by transversely polarized electrons, photon asymmetry in, 17: 6978
emission of double and single internal, in nuclear beta decay, 17: 7152
polarization of, from 3.5-Mev electrons, 17: 7112 (NP-12330(p.162-5))
spectrum of, from electrons and positrons, high-frequency region of, 17: 6983
BROMINE
determination of, activation, 17: 5983
BROMINE ISOTOPES Br-79
half life of short-lived, 17: 5983
use of short-lived, for activation analysis of bromine, 17: 5983
BROMINE ISOTOPES Br-80
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
BROMINE ISOTOPES Br-82
determination in feces, design of scintillation counter for, 17: 5734
production in solid hexabromoethane, radiation and thermal effects on, 17: 6150
tracer applications in industry, 17: 6372
BROOKHAVEN ALTERNATING-GRADIENT SYNCHROTRON
drift-tube alignment in linac injector for, 17: 7343 (BNL-6511 (p.381-5))
preinjection beam measurements for, 17: 7342 (BNL-6511(p.338-80))
BROOKHAVEN BEAM RESEARCH REACTOR
design of core and fuel elements for, 17: 7641
BUBBLE CHAMBERS
bubble density in hydrogen, 17: 6383 (BNL-5866)
pressure effects in, 17: 6472
track-centering device design for, 17: 6464
track-measuring stage design for, 17: 6463
BUBBLES
density of, in hydrogen bubble chamber, 17: 6383 (BNL-5866)
growth in boiling liquid, dynamics of, 17: 6235
BUILDING MATERIALS
physical properties, 17: 5666 (AD-274294)
shielding properties of, 17: 6720
BULK SHIELDING FACILITY
kinetics, 17: 7606(R) (ORNL-1515)
BUTADIENE
reactions with hydrogen atoms, 17: 6145
BUTADIENE POLYMERS
radioinduced polymerization of, energy transfer in, 17: 6151
1-BUTANOL
determination of, in kerosene-tributyl phosphate mixtures using infrared absorption spectrometry, 17: 5973 (PG-Report-406)
2-BUTENE
reactions with hydrogen atoms, 17: 6145
2-BUTENE, 2,3,-DIMETHYL-
reactions with hydrogen atoms, 17: 6145
BUTYL PHOSPHATE COMPLEXES
with uranyl nitrate, spectra in organic solvents, 17: 6081
BUTYL PHOSPHATES
analysis of mixture of, with kerosene for 1-butanol using infrared absorption spectrometry, 17: 5973 (PG-Report-406)
analysis of mixtures with kerosene for butex by infrared absorption spectrometry, 17: 5975 (PG-Report-414)
determination of, in kerosene-tributyl phosphate, 17: 5971 (PG-Report-402)
determination of, in aqueous raffinates using infrared absorption spectrometry, 17: 5974 (PG-Report-407)
BUTYRIC ACID
meson (π^-) capture by hydrogen in, 17: 7083 (JINR-P-1081)

C

CABLES
design and evaluation of high-temperature radioresistant electric, for remote uses, 17: 6208 (XDC-61-3-66)
CADARACHE REACTORS (RAPSODIE)
description and design of, 17: 7629
CADMIUM
determination in niobium, tantalum, and tungsten, spectrometric, 17: 6022

determination in uranium by precipitation with bismuthiol, 17: 5953 (IEA-48)
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
separation of, radiochemical and vacuum distillation, 17: 6135

CADMIUM ISOTOPES Cd-110
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))

CADMIUM ISOTOPES Cd-114
energy levels, 17: 7210
energy levels at 557 and 1282 kev, lifetimes of, 17: 7283

CADMIUM ISOTOPES Cd-116
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))

CADMIUM OXIDES
stability, 17: 6664 (MND-M-2346)

CADMIUM SULFATES
transfer between heavy and light water, ionic hydration in, 17: 6096

CADMIUM SULFIDE CRYSTALS
fluorescence properties of, 17: 6092
gamma conductivity in, kinetics of, 17: 6886(T)

CADMIUM TANTALATES
compatibility with copper and silver, 17: 6714
preparation, 17: 6714
properties as neutron absorber, 17: 6714

CADMIUM TELLURIDES
performance of p-n junctions of, as x-ray spectrometers, 17: 6458

CALCITES
radiation effects on, thermal neutron, 17: 7136 (NP-12330(p.429-31))

CALCIUM
bibliography on metabolism in animals and man, 17: 5747
bone metabolism, tracer studies in man, 17: 5742
content in epiphyseal cartilage in rat tibia, electron probe for measurement of, 17: 5727
content in fetal body fluids, 17: 5731
conversion of plasma to milk in lactating dairy cows, tracer study, 17: 5722
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)
determination using carbon-14 labeled oxalic acid and liquid scintillation, 17: 5992
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
separation from lanthanum by ion exchange, 17: 6180 (IA-769)
sorption in epi- and metaphysis after local radiation damage, 17: 5901
thorium substitution of, in apatites, 17: 6061

CALCIUM CARBIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)

CALCIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
with uranyl acetate in aqueous solution, spectra of, 17: 6081

CALCIUM ISOTOPES
occurrence of, in meteorites, minerals, and rocks; bibliography on, 17: 6270(R) (NYO-10325)

CALCIUM ISOTOPES Ca-40
deuteron reactions (d,p) at 13.8 Mev, proton polarization from, 17: 7286
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
nuclear properties of, calculation of, 17: 7249
nucleon levels in, 17: 7088 (NP-12330(p.1-14))
optical potential of, calculation of imaginary part of, 17: 7143 (TID-17357(Pt.II))
proton reactions (p,p'2γ) of, double photon decay in, 17: 6957 (TID-17357(Pt.I))

CALCIUM ISOTOPES Ca-47
bone metabolism in man, 17: 5742

CALCIUM NITRATES
transfer between heavy and light water, ionic hydration in, 17: 6096

CALCIUM OXIDES
spectra at 90 and 320°K, cathodoluminescence, 17: 6089
$CaO-La_2O_3-SiO_2$, phase studies, 17: 6101

CALCIUM THORIUM PHOSPHATES
precipitation of, 17: 6061

CALCIUM TITANATES
emissivity, 17: 6675(R) (PWA-2128)
emittance at high temperatures, total hemispherical, 17: 6731

CALIFORNIUM
separation from nitrate solutions by ion exchange, comparison with other actinides, 17: 6182 (IA-783)

CALORIMETERS
design and performance of isothermal, for reactor radiation dosimetry, 17: 6452
development of electrically compensated differential, for measurement of in-pile heat evolution, 17: 6386 (CEA-2190)

CALORIMETRY
use of vacuum, in exploding wire studies, 17: 6425

CAMERAS
powder diffraction, lattice parameter measurement by, 17: 6392 (GAT-T-973)

CANADA
radiation hazards to population, from diagnostic uses, 17: 6335

CANDU REACTOR
development of on-power refueling machine for, 17: 7609(R) (SRO-75)

CAPE THOMPSON–CAPE SEPPINGS AREA (ALASKA)
bioenvironmental features of Ogotoruk Creek Area, 17: 6273 (TID-17226)

CARBAMIC ACID, DITHIO-
protective effects against radiation injuries in mice, 17: 5924

CARBIDES
plasma spraying of, 17: 6556

CARBON
atomic energy levels, intensity of forbidden emission lines, 17: 6903
bibliography on, 17: 6521 (NP-12417)
crystal structure disorders of fine crystalline, 17: 6694(T) (AEC-tr-5565)
determination in sodium, 17: 5948 (AWRE-O-62/62)
effects of additions of, on extrusion and forging of molybdenum alloys, 17: 6589 (ASD-TDR-62-670)
electric conductivity, 17: 6670(R) (NP-12350)
gamma reactions (γ,p) at 150 Mev, proton spectrum from, 17: 7202
mechanical properties, 17: 6670(R) (NP-12350)
oxidation kinetics, 17: 6531(R) (TID-17504)
particle scattering by, energy-loss spectra from, 17: 7157
proton elastic scattering at 660 Mev, cross sections for, 17: 7081 (JINR-P-1025)
reaction with carbon dioxide, rate constants for, 17: 6531(R) (TID-17504)
thermal properties, 17: 6670(R) (NP-12350)
transfer from paper to machines, 17: 6223

CARBON (ACTIVATED)
use for sampling airborne iodine isotopes, 17: 5754 (PG-Report-408)

CARBON COATINGS
structure of, on ThC_2–UC, particles, 17: 6655 (GA-3067)

CARBON DIOXIDES
corrosive effects on stainless steel, 17: 6560 (AAEC/E-98)
oxidation of uranium carbide by, 17: 6665 (NAA-SR-7482)
radioinduced decomposition by fission products, 17: 6161
radioinduced reactions with nitrogen by fission products, 17: 6161
radioinduced reduction in aqueous solutions, formation of organic compounds in, 17: 6168
reaction with carbon, rate constants for, 17: 6531(R) (TID-17504)
uptake and transport by plants, tracer studies of daily periodicity in, 17: 5756

CARBON FILMS
kinetics of formation of, 17: 6531(R) (TID-17504)

CARBON ION BEAMS (C-12)
reactions with carbon-12, total decay into alpha particles, 17: 7282

CARBON ISOTOPES C-11
energy levels from boron-10 (p,γ) reactions at 12.5 Mev, 17: 7176
recoil ranges from proton reactions (p,pn) with carbon-12, 17: 7147 (UCRL-9911)

CARBON ISOTOPES C-12
deuteron reactions (d,p) at 0.8 to 1.2 Mev, proton polarization in, 17: 7271
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
energy level configurations in, doublets from, 17: 7105 (NP-12330 (p.122-5))
energy levels, 17: 7102 (NP-12330(p.104-8))

meson (μ^-) capture by, partial and total probabilities of, 17: 6986
meson (π^+) reactions (π,3α) at 80 Mev, 17: 7288
nucleon levels in, 17: 7088 (NP-12330(p.1-14))
proton elastic and inelastic scattering at 31.1 Mev, 17: 7243
proton elastic scattering by, polarization from, 17: 7166
proton inelastic scattering at 182 Mev, 17: 7265
proton reactions at 57 Mev on, proton distributions from, 17: 7197
proton reactions (p,pn) at 0.25 to 6.2 Bev, recoil ranges from, 17: 7147 (UCRL-9911)
proton reactions (p,γ) on, spectra from, 17: 7153
proton reactions (p,np), cross sections for, 17: 7188
reactions with carbon ion beams (C^{12}), total decay into alpha particles, 17: 7282
scattering of helium-3 particles by, 17: 6957 (TID-17357(Pt.I))
triton reactions (t,p) at 0.32 to 1.18 Mev, cross sections for, 17: 7296

CARBON ISOTOPES C-13
determination in amino acids by continuous scintillation counting, 17: 5709
deuteron reactions (d,n) at 3.9 Mev, differential cross sections for, 17: 7239
gamma reactions (γ,d), mechanisms in, 17: 7185

CARBON ISOTOPES C-14
age determination using, 17: 6295
age determination using, 17: 6298
age determination using, 17: 6299
determination in labeled compounds using gas-flow counter, 17: 6470
determination in solution using scintillation detector, 17: 6446
isotope effects in Beckmann rearrangement, reverse, 17: 6065
proton reactions (p,d) and (p,t) at 17.6 to 20 Mev, 17: 7217

CARBON OXIDES
sub-, chemistry of, 17: 6531(R) (TID-17504)

CARBON SYSTEMS
C–Nb, metallography, 17: 6525 (TID-7625(p.8-19))
C–Ni, diffusion of, in Ni–Ti alloys, 17: 6591 (ASD-TDR-62-734)
C–Pu, phase studies, 17: 6638 (ANL-FGF-343)
C–Th–U, thermal-conductivity of stoichiometric, 17: 6511(R) (BMI-1593(Del.))

CARBON TETRACHLORIDE
radiation effects on reactions of, with white phosphorus, 17: 6167

CARBON TETRAFLUORIDE
corrosive effects on Inor-8, 17: 7562(R) (ORNL-3369)

CARCINOMAS
radiotherapy of parotid gland adeno-, effects on cerebral and cranial bones, 17: 5849
radiotherapy of uterine cervix, proctitis after, 17: 5893
radiotherapy of uterine cervix, effects on urinary tract, 17: 5815
therapy using bone marrow transfusions in man, 17: 5921

CAROLINAS-VIRGINIA TUBE REACTOR
development, 17: 7609(R) (SRO-75)
fuel rod irradiation testing, 17: 6739 (CVNA-153)

CARTILAGE
calcium content in epiphyseal, in rat tibia, 17: 5727

CASTLE OPERATION
fallout effects in man, eight-year survey on Marshallese exposed to, 17: 5699 (BNL-6503)

CATHODE-RAY TUBES
use of, in Cintel flying spot microscopy, 17: 6529 (TID-7625(p.52-62))

CATIONS
reactions on electron-emitting surfaces, effects on exoelectron emission, 17: 6831

CATTLE
abnormal thyroid radioactivity, in Portugal, 17: 5740
conversion of plasma calcium and phosphorus to milk in lactating cows, tracer study, 17: 5722
iodine-131 content in milk of, effects of pasture and stored feed on, 17: 6356
iodine-131 excretion in milk of dairy, effects of mild hyperthyroidism on, 17: 5721
iodine-131 release by thyroid gland in dairy, effects of forage on, 17: 5723

CAVES
construction of, evaluation of metal-work design and fabrication for, 17: 6204 (BNL-5850)
descriptions of Western European, 17: 6157
design for radiocrystallographic study of irradiated fuel elements, 17: 6758
layout criteria for, 17: 6203 (BNL-5820)
shielding window design, 17: 7498 (USNRDL-TR-594)

CAVITATION
detection and location of, apparatus for, 17: 6401 (MATT-142)

CENTRIFUGAL PUMPS
performance of liquid metal, 17: 7606(R) (ORNL-1515)

CENTRIFUGES
circuit for stopping ultra-, in case of vacuum loss or sample leakage, 17: 6221
vector-following fixtures for, 17: 6206 (SCTM-219-62(73))

CERAMIC COATINGS
deposition on reactor materials, 17: 7606(R) (ORNL-1515)

CERAMIC MATERIALS
bibliography on, 17: 6521 (NP-12417)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
examination of irradiated, using electron microscopy, 17: 6657 (HW-SA-2550)
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))

CERIUM
determination in minerals and rocks, spectrographic, 17: 6008
determination using 2-methyl-8-quinolinol, spectrophotometric, 17: 5988
heat of solution of, in hydrochloric acid, 17: 6033 (BM-RI-6146)
phase diagram at 20 to 350°C at a pressure of 80×10^6 kg/cm^3, 17: 6730
valency of phases in, 17: 6047 (TID-14535)

CERIUM ACETYLACETONATES
beta decay of cerium-144-labeled, chemical aspects of, 17: 6131 (TID-13363)

CERIUM ALLOYS
pyrophoricity, 17: 6693(T) (AEC-tr-5544)

CERIUM CARBIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)

CERIUM CHLORIDES
heat of solution of, in hydrochloric acid, 17: 6033 (BM-RI-6146)

CERIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007

CERIUM ISOTOPES
alpha decay systematics for, 17: 7199

CERIUM ISOTOPES Ce-137
isomeric-pair production by neutron activation, yield ratios of, 17: 7248

CERIUM ISOTOPES Ce-141
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
gamma specific emission coefficient, 17: 6431 (CEA-2036)

CERIUM ISOTOPES Ce-144
beta decay of, chemical effects of, 17: 6131 (TID-13363)
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
elimination in rats, effectiveness of DTPA and DEETA, 17: 5739

CERIUM NITRIDES
preparation by ammonia or nitrogen nitridation, 17: 6100

CERIUM OXIDES
emissivity, 17: 6675(R) (PWA-2128)
separation from lanthanum oxides by distillation in solar furnace, 17: 6069

CERIUM OXYTELLURIDES
preparation and properties, and crystalline structure, 17: 6068

CERMETS
corrosion by fused fluorides and liquid metals, 17: 7606(R) (ORNL-1515)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)

CESIUM
electric and physical properties of, at high temperatures, 17: 6635(R) (AGN-8069)
ionization for space propulsion systems, 17: 6544
scattering by mercury crossed beams, velocity dependence of differential cross sections for, 17: 6836
separation by solvent extraction using nitrobenzene, mechanism of, 17: 6194
separation from mixed fission products by ion exchange, 17: 7550(R) (HW-74761(p.6.1-20))

separation from Purex Process wastes by ion exchange, 17: 7550(R) (HW-74761(p.6.1-20))
spectra of, infrared emission, 17: 6843
use as a source of electrons and ions, 17: 6788(R) (EDR-2791)
CESIUM CHLORIDES
transfer between heavy and light water, ionic hydration in, 17: 6096
CESIUM IONS
adsorption on rhenium, tantalum, and tungsten, 17: 6803 (UCRL-6389)
propulsion using, characteristics for space, 17: 6900
CESIUM ISOTOPES Cs-123
half life, 17: 7194
CESIUM ISOTOPES Cs-125
half life, 17: 7194
CESIUM ISOTOPES Cs-134
gamma specific emission coefficient, 17: 6431 (CEA-2036)
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
CESIUM ISOTOPES Cs-137
content in dried milk products, vegetation zone relation to, 17: 5752 (HW-SA-2337)
content in Japanese population, 1960 to 1962, 17: 5691
content in milk, effects of pasture and stored feed consumption by cows on, 17: 6356
design of kilocurie therapy unit using, as gamma source, 17: 5764 (AERE-R-3334)
determination in man by whole-body counting, 17: 5672(R) (LAMS-2780 (p.130-80))
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
excretion in man, effects of dietary potassium levels, 17: 5713
gamma specific emission coefficient, 17: 6431 (CEA-2036)
maximum permissible concentration for inhaled air, 17: 6331
metabolism in dogs, 17: 5670(R) (LAMS-2780(p.17-84))
monitoring in Ottawa River, program for, 17: 6334
properties in radiotherapy, 17: 5697
CESIUM NITRATES
solubility in organic solvents, effects of water on, 17: 6190(T) (AEC-tr-5574)
transfer between heavy and light water, ionic hydration in, 17: 6096
transport number of cation in fused, 17: 6080
CESIUM SULFATES
solubility in organic solvents, effects of water on, 17: 6190(T) (AEC-tr-5574)
CHAIN REACTIONS
statistical theory of, 17: 7059
statistical theory of, 17: 7060
statistical theory of, 17: 7061
CHARGED PARTICLE BEAMS
behavior in accelerator cavities, 17: 7334 (BNL-6511(p.283-8))
design study of debunchers for linac injectors of, 17: 7332 (BNL-6511(p.267-73))
development of bunchers for linac injectors of, 17: 7331 (BNL-6511 (p.261-6))
extraction from Berkeley 88-in. cyclotron, 17: 7404
extraction from Berkeley 88-in. cyclotron, 17: 7405
extraction from isochronous cyclotron, 17: 7411
extraction from radial ridge cyclotron, 17: 7402
extraction from 70-inch cyclotron, 17: 7369
handling system for Univ. of Mich. cyclotron, 17: 7364
handling system for cyclotron external, 17: 7409
magnet system for Univ. of Mich. cyclotron, 17: 7367
orbit calculations for AVF cyclotron, 17: 7381
orbit calculations for cyclotrons, computer programs for, 17: 7384
orbit stability in sector-focused accelerators, 17: 7382
orbit stability in sector-focused cyclotrons, field effects, 17: 7383
orbits in AVF cyclotron, computer program for, 17: 7388
phase measurements in ORIC, 17: 7410
phase studies in ORIC, 17: 7357
production in 22-inch spiral ridge cyclotron, 17: 7370
production with spiral ridge cyclotron, 17: 7355
quality in Berkeley 88-inch cyclotron, 17: 7389
CHARGED PARTICLES
behavior in a sinusoidal electromagnetic field, evaluation of, 17: 6816
diffusion in plasma column, 17: 7474
dosimetry and biological effects of heavy, in stratosphere, 17: 5765 (AFCRL-62-244)
energy losses in a medium, radiative corrections to, 17: 6897
intensity in outer Van Allen belt, 17: 6926
interactions of, macroscopic electrostatic and magnetostatic energy in electromagnetic, 17: 6834
motion in static asymmetric magnetic mirror geometry, 17: 7465
motion in static axially symmetric magnetic mirror and cusp geometries, 17: 7466
penetration and energy loss in tissue, 17: 5766 (BNL-5538)
radiation emission by high-energy, in homogeneous media, 17: 7038
scattering of, measurement of multiple, in energy-loss interactions, 17: 6954 (NP-12259)
stable betatron oscillations of, in a nonlinear magnetic field, 17: 7417
thermodynamics of isolated, 17: 6826
CHEMICAL ANALYSIS
developments in quantitative inorganic, 17: 6006
CHEMICAL ENGINEERING
computer applications in, 17: 5936 (HW-SA-2815)
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
CHEMICAL PROPHYLAXIS
of radiation injuries of hematopoietic system, screening tests on 47 compounds, 17: 5910 (TID-17379)
of radiation injuries in bone marrow, 17: 5831
CHEMICAL WARFARE AGENTS
food contamination, 17: 6339
CHEMICALS AND REAGENTS
use of *vic*-dioximes as, 17: 5954 (IS-431)
CHERENKOV RADIATION
radiative corrections to, 17: 6897
CHLORIDE IONS
determination in water, colorimetric, 17: 5977 (TID-15070)
CHLORIDES
determination in biological fluids and tissues by isotope dilution, 17: 5999
CHLORINE
nitrogen nucleus reactions at 27.5 Mev, 17: 7252
reactions with trivalent plutonium, 17: 6057(T) (AEC-tr-5552)
CHLORINE ISOTOPES Cl-35
meson (μ) capture by, shell model calculation of rates for, 17: 7274
CHLORINE ISOTOPES Cl-37
gamma spectra of, 17: 7158
meson (μ) capture by, shell model calculation of rates for, 17: 7274
CHLORINE ISOTOPES Cl-38
tracer applications in industry, 17: 6372
CHOLANTHRENE, 3-METHYL-
induction of breast tumors in rats, 17: 5839
CHOLESTEROL
radiation effects on synthesis of, in liver in rats, 17: 5792
CHROMATOGRAPHIC SEPARATIONS
of nucleic acids, 17: 5675(R) (LAMS-2780(p.246-317))
CHROMATOGRAPHY
development of programmed cryogenic gas, for separation of complex mixtures, 17: 6000
theory of displacement in, using plate theory concepts, 17: 6004
CHROMIUM
alloying effects on zirconium alloy corrosion, 17: 6581
bibliography on, 17: 6521 (NP-12417)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
deposition of, on beryllium, 17: 7592(P)
determination in nickel steel and electro-etch residues, activation, 17: 5984
deuteron reactions (d,t) at 21.6 Mev, 17: 6780(R) (ANL-6603(p.52-5))
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
effects on corrosion of iron–zirconium alloys by steam at 750°F, 17: 6561(R) (ARF-2198-34)
neutron resonance cross sections, 17: 7595(R) (ACNP-62018)
nuclear polarization in, method for, 17: 7267(T)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
CHROMIUM ALLOYS
cladding on reactor fuel elements, high-temperature properties of,

17: 7571 (TID-17402)
end milling of U-500, 17: 6614
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Al–Cr–Y, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)
Be–Cr, corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
Cr–Co–Mo–Ni, drilling of hardened Astrolov, 17: 6617
Cr–Co–Ni–W, machining characteristics of HS-25, 17: 6609
Cr–Co–Ni–W, machining of HS-25, 17: 6611
Cr–Cu–Fe–Mo–Ni–Ti, corrosion of, by reactor fuel dissolver solutions, 17: 6566 (HW-SA-2307)
Cr–Fe–Mo–Pu, mechanical properties of, 17: 6511(R) (BMI-1593(Del.))
Cr–Fe–Ni, corrosion by fused fluorides, 17: 7606(R) (ORNL-1515)
Cr–Fe–Ni, corrosion by carbon dioxide, 17: 6560 (AAEC/E-98)
Cr–Fe–Y, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)
Cr–Fe–Zr, corrosion by steam at 750°F, 17: 6561(R) (ARF-2198-34)
Cr–Fe–Zr, corrosion of, oxygen gradients in, 17: 6579
Cr–Ni–Zr, corrosion of, oxygen gradients in, 17: 6579
Cr–Zr, corrosion by water at 680°F, 17: 6561(R) (ARF-2198-34)
Cr–Zr, corrosion by steam at 750°F, 17: 6561(R) (ARF-2198-34)
Cr–Zr, strength, 17: 6561(R) (ARF-2198-34)

CHROMIUM COATINGS
Cr–Si–Ti, for niobium alloys, 17: 6510 (ASD-TDR-62-934)

CHROMIUM COMPLEXES
with neptunium in perchloric acid, effects of trivalent metallic perchlorates on, 17: 6074

CHROMIUM ISOTOPES
occurrence of, in secondary minerals, 17: 6257 (IS-438)

CHROMIUM ISOTOPES Cr-51
accumulation in aquatic insects, 17: 5702 (HW-SA-2848)
determination in feces, design of scintillation counter for, 17: 5734
energy level at 750 kev, lifetime of, 17: 6958 (UCRL-7091)
gamma specific emission coefficient, 17: 6431 (CEA-2036)

CHROMIUM MINERALS
chromium isotopic composition of secondary, 17: 6257 (IS-438)

CHROMIUM OXIDES
emissivity, 17: 6675(R) (PWA-2128)
emittance at high temperatures, total hemispherical, 17: 6731
Cr_2O_3–NiO–SiO_2, endurance of aluminum phosphate-bonded coating of, 17: 6675(R) (PWA-2128)

CHROMIUM SILICIDES
thermoelectric properties, 17: 6771 (AD-276005)

CHROMOSOMES
iodine-131 effects on anomalies in, of circulating leukocytes in man, 17: 5836
kinetics of two-bit exchanges, mathematical analysis, 17: 5690
radiation effects on chemical reactions, 17: 5875
radiation effects on leukocyte, in therapy for thyrotoxicosis, 17: 5845
radiation effects on aberrations of, diagnostic, 17: 5846
radioinduced aberrations in tumor cells, effects on cell viability, 17: 5890
radiosensitivity, calculation of oxygen effect, 17: 5833
radiosensitivity, effects of age and dose, 17: 6330

CIRCUITS
design of balanced electronic, 17: 6428(P)
development for data smoothing, 17: 6505 (TID-17315)
for strain gages, 17: 6405 (SCTM-364-61(73))
heat dissipation in micromodule packages, 17: 6229 (SCTM-233-62(14))
reliability improvement by sterilization in monitoring, 17: 6407 (TID-15453)

CITRATES
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)

CIVILIAN DEFENSE
design and cost factors for shelters to accommodate 100 persons for 14 days, 17: 6324 (USNRDL-TR-582)
effectiveness of structures for gamma shielding, model studies, 17: 7497 (DRCL-364)
evaluation of kill probability in basement and underground family shelters in target area, 17: 6345
fallout shelter survey, comparison of aerial photographic and documentary methods, 17: 6302 (AD-276119)
food supplies for emergency use, 17: 6339
radioactive contamination of unharvested and processed foods, 17: 6340

CLINCH RIVER
dilution factors and monitoring of, 17: 7653(R) (ORNL-TM-396)

COATINGS
bibliography on, 17: 6521 (NP-12417)
heat transfer between cores and, 17: 6237
radiosensitivity of, review of, 17: 6704
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))

COBALT
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination of, in aluminum-magnesium alloys, 17: 5960 (PG-Report-337)
determination of, in magnesium-manganese alloys, 17: 5960 (PG-Report-337)
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
isotope exchange thermodynamics of di- and trivalent systems of, 17: 6084
neutron form factors and spin density distributions for, comparison with Hartree-Fock calculations, 17: 6646 (BNL-5674)
separation from copper and nickel by ion exchange, 17: 6180 (IA-769)
temperature effects on mechanical properties of, cryogenic, 17: 6542
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))

COBALT ALLOYS
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
drilling of HS-25, 17: 6615
end milling of U-500, 17: 6614
high-strength, bibliography on, 17: 6521 (NP-12417)
oxidation of coatings of, 17: 6562(R) (ARF-B-6001-1)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Be–Co, corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
Co–Fe, cobalt nucleus orientation in, 17: 7115 (NP-12330(p.179-85))
Co–Ho, magnetic structure of, 17: 6706
Co–Ni, plastic deformation of single crystals of, 17: 6695(T) (AEC-tr-5568)
Co–Y, magnetic structure of, 17: 6706
Cr–Co–Mo–Ni, drilling of hardened Astrolov, 17: 6617
Cr–Co–Ni–W, machining characteristics of HS-25, 17: 6609
Cr–Co–Ni–W, machining of HS-25, 17: 6611

COBALT CHLORIDES
salicylaldehyde-triethylene tetramine, annealing radiation damage in, 17: 7135 (NP-12330(p.422-8))

COBALT ISOTOPES Co-54
decay scheme, 17: 7138 (PUC-1962-61)

COBALT ISOTOPES Co-60
determination in human lungs, whole-body counting, 17: 5704 (TID-12790)
gamma specific emission coefficient, 17: 6431 (CEA-2036)
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
orientation in ferromagnetic alloys, 17: 7115 (NP-12330(p.179-85))

COBALT SILICIDES
thermoelectric properties, 17: 6771 (AD-276005)

COINCIDENCE COUNTERS
design of anti-, for low-level beta counting, 17: 6456

COINCIDENCE MEASUREMENTS
absolute, improvement of methods for, 17: 6448
use of anti-, in measuring activity of radioactive materials, 17: 6451
uses in excited state lifetime analysis, 17: 6450

COLD NEUTRONS
scattering by polycrystalline beryllium oxide, inelastic, 17: 7130 (NP-12330(p.384-91))

COLLIMATORS
design of double, for gamma rays, 17: 5732

COLORIMETRY
precision and sensitivity improvements in, by automatic instrumentation, 17: 5977 (TID-15070)

COLUMBIA RIVER
ecology, effects of accumulation of radionuclides by aquatic insects,

17: 5702 (HW-SA-2848)
radioisotope removal from, by natural processes, 17: 6310 (HW-SA-2411)
telemetering installation for reporting data on, 17: 6394 (HW-SA-2481)
COMBUSTION ANALYSIS
prevention of spattering during high-temperature, 17: 5976 (TID-14592)
COMMUNICATION SYSTEMS
development of, for transmission of information, 17: 6801(R) (TID-17303)
COMMUNICATION THEORY
research programs on, 17: 6801(R) (TID-17303)
COMPTON EFFECT
on bound electrons in gold, cross section measurements for, 17: 6792(R) (ISS 62/14)
COMPUTER PROGRAMS
ABRAC, BRIC, and CNCR, for analysis of boiling effects in water moderated reactors, 17: 7574 (WAPD-T-1225)
development of, summary for nuclear superheat program, 17: 7601(R) (GNEC-254)
development summary of Monte Carlo, for reactor and shield analysis, 17: 7542(R) (GEMP-75)
FEVER, for one-dimensional few-group depletion analysis, 17: 7540 (GA-2749)
for analysis of ionization measurements, 17: 6785 (CERN-62-31)
for neutron group diffusion computations, methods used in, 17: 7057 (TID-14262)
for neutron shielding calculations, 17: 7496 (AEEW-M-261)
for reactor dynamic parameters, 17: 7529 (AEEW-R-179)
for stress analysis in thin shells, Fortran II, 17: 6507
MELEAGER, for fuel cycle analysis, calibration of, 17: 7551(R) (HW-74761(p.7.1-28))
POLLY, for cylindrical reactor design for IBM-650, 17: 6496 (CNEN-140)
preparation of, use of ALGOL60 in, 17: 6504 (TID-15527)
COMPUTERS
circuit design for Pattern Articulation Unit, 17: 6506 (TID-17350)
circuits of, operation of 3-bit bubbling register in, 17: 6499 (NP-12308)
design of analog, for quadrupole magnet design, 17: 7346 (TID-17429)
development, 17: 6801(R) (TID-17303)
development of ternary, using tunnel diode, 17: 6501 (TID-14155)
operation of, method of timing, 17: 6500 (SCTM-144-62(24))
operational efficiency of, in data processing, 17: 5654 (HW-SA-2502)
program for derivation of transfer functions, 17: 7530 (AEEW-R-189)
programs for AVF cyclotron orbits, 17: 7387
programs for AVF cyclotron orbits, 17: 7388
programs for cyclotron orbits, 17: 7384
programs for cyclotron trim-coil currents, 17: 7386
programs for ORIC field design, 17: 7385
transfer memory of Pattern Articulation Unit, 17: 6498 (NP-12307)
use for analysis of gamma pulse height distributions, 17: 6442 (USNRDL-TR-592)
uses in chemical engineering, 17: 5936 (HW-SA-2815)
uses in simulating atomic processes and reactors, 17: 6496 (HW-SA-2552)
CONCRETE AGGREGATES
mixing conditions, tracer study of, 17: 6374
CONCRETES
mitigation of shock wave effects by lightweight vermiculite, 17: 5668 (DASA-1263)
radiography of structures, 17: 6249
CONFERENCES
Applications of Radioisotopes and Nuclear Emissions in National Economy of USSR, Riga, 1960, 17: 6369
Colloquium on Detection of Underground Nuclear Explosions, California Inst. of Tech., Pasadena, Dec. 14–15, 1961, 17: 6265 (NP-12297)
Corrosion of Reactor Materials, I, Salzburg, Austria, June 4–8, 1962, 17: 6583
International Conference on Sector-Focused Cyclotrons, Los Angeles, April 1962, 17: 7352
Minutes of the Conference on Linear Accelerators for High Energies, Brookhaven National Laboratory, Aug. 20 to 24, 1962, 17: 7308 (BNL-6511)
Nuclear Physics, Madras, February 28–March 2, 1962, 17: 7087 (NP-12330)
on materials for advanced applications, San Francisco, 1962, 17: 6541
Radiation Research and Treatment, Munich, 1960, 17: 5698
The Joining of Rarer Metals, London, April 1961, 17: 6627
Thirteenth Metallographic Group Meeting, Armour Research Foundation, Jan. 14–15, 1959, 17: 6524 (TID-7625)
CONVECTION
heat transfer and temperature and transient velocity fields in fluid adjacent to vertical plate, 17: 6233
CONVECTION (FREE)
heat transfer and temperature and transient velocity fields in fluid adjacent to vertical plate, 17: 6233
CONVERSION ELECTRONS
spectral intensity of, determination by photographic methods, 17: 6823
COPPER
brazing to Inconel X, 17: 7606(R) (ORNL-1515)
cladding studies, 17: 6673 (ORNL-2065)
corrosion, 17: 6572 (OTS-61-31480)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
determination in beryllium, neutron activation, 17: 6027
determination of, in uranium and uranium compounds, 17: 5957 (PG-Report-294)
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
gamma pair production cross sections for, 17: 7116 (NP-12330(p.186-92))
heat of sublimation and vaporization of solid, 17: 6093
helium nucleus (helium-3) scattering at 31 Mev, elastic, 17: 7148 (UCRL-9996)
ion ranges in, determination from collection experiments, 17: 6820
mesic atom (μ^-) decay in, anomaly in, 17: 6888
neutron capture cross sections, fast, 17: 7606(R) (ORNL-1515)
neutron polarization in, measurement as function of scattering angle, 17: 7065
neutron scattering by, in beta brass, 17: 6705
neutron total cross sections at 14 Mev, 17: 7095 (NP-12330(p.61-5))
proton spallation at 3 and 30 Bev, energy dependence of product yields, 17: 7233
radiation damage in, spot density and diameter of neutron, 17: 6763
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
radiation effects on, 17: 6733 (62-GC-209)
rare gas ions reactions at 100 to 30,000 ev, yields of secondary ions from, 17: 7268
separation from cobalt and nickel by ion exchange, 17: 6180 (IA-769)
separation from metallic mixture by ion exchange chromatography, 17: 5991
separation of, radiochemical procedure for, 17: 6132(R) (TID-17272)
surface properties of, studies by mass spectrometry, 17: 6634 (AFOSR-2273)
thermal conductivity of radiator fins of, 17: 6673 (ORNL-2065)
COPPER ALLOYS
Al–Cu, strain fields in, 17: 6591 (ASD-TDR-62-734)
Al–Cu, thermal conductivity, 17: 6673 (ORNL-2065)
Be–Cu, structural hardening in, 17: 6710
Bi–Cu, coprecipitation of radioactive tracers in, 17: 6683 (UCRL-6452 (Pt.II))
Cr–Cu–Fe–Mo–Ni–Ti, corrosion of, by reactor fuel dissolver solutions, 17: 6566 (HW-SA-2307)
Cu–Mn–Ni, corrosion by nitric acid, 17: 6192(T,R) (EURAEC-382)
Cu–Mo–Zr, analysis for boron by direct absorptiometric method, 17: 5965 (PG-Report-362)
COPPER CHELATES
spectra of, analysis of polarization of ligand-field, 17: 6115 (NYO-9868)
COPPER COMPOUNDS
protective effects of salts on iodine-131 toxicity in animals, 17: 6005
COPPER FILMS
adsorptive properties for stearic acid from hexadecane solution, 17: 6078
COPPER ISOTOPES
precipitation in bismuth alloys, 17: 6683 (UCRL-6452(Pt.II))
COPPER ISOTOPES Cu-58
decay scheme, 17: 7138 (PUC-1962-61)
COPPER ISOTOPES Cu-63
proton inelastic scattering at 6.6 Mev, 17: 7178
proton reactions (p,p') and (p,n), cross sections for, 17: 7144 (TID-

17357(Pt.III))
COPPER ISOTOPES Cu-64
accumulation in aquatic insects, 17: 5702 (HW-SA-2848)
production and use of, 17: 6171
reaction mechanisms of enzymes, 17: 5696
tracer use in air movement and pollution studies, 17: 6375
COPPER ISOTOPES Cu-65
proton inelastic scattering at 6.6 Mev, 17: 7178
proton reactions (p,p') and (p,n), cross sections for, 17: 7144 (TID-17357(Pt.III))
COPPER SULFATES
transfer between heavy and light water, ionic hydration in, 17: 6096
CORROSION
bibliography on products of, in high-temperature water systems, 17: 6578
book: *Uranium Metallurgy. Vol. II. Uranium Corrosion and Alloys*, 17: 6540
in nuclear reactors at high temperatures, 17: 6567 (HW-SA-2745)
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
theory and mechanism, 17: 6572 (OTS-61-31480)
CORTISONE
protective effects against radiation injuries to guinea pig skin, 17: 5915
COSMIC ELECTRONS
density in F2 region, decay of, 17: 6933
diffusion in Van Allen radiation belts, 17: 6941
energy spectra of, measurements by Discoverer satellites 29 and 31, 17: 6917 (UCRL-6792-T)
flux at 12 earth radii during sudden commencement, 17: 6922
intensity of, 17: 6939
COSMIC MESONS (μ)
detection by human eyes, 17: 6932
origin of high-energy, hyperon hypothesis for, 17: 6940
spectra at 0.7 to 30 Bev/c, at sea level, 17: 6918
COSMIC NEUTRONS
Forbush decrease measurements, 17: 6929
COSMIC PARTICLES
capture of small absorbing, by solar radiation field, 17: 6914
effects on chorus increases at auroral zone, 17: 6838
intensity in radiation belts, 17: 6935(T)
reactions on nuclei, jet distributions from 10^{13}-ev, 17: 6919
spectra of heavy primary, 17: 6931
COSMIC PHOTONS
origin of high-energy, hyperon hypothesis for, 17: 6940
origin of Jovian decametric, 17: 6912
COSMIC PROTONS
energy spectrum at 100 ev to 20 kev, 17: 6923
flux at 12 earth radii during sudden commencement, 17: 6922
flux in July 1961, 17: 6920
COSMIC RADIATION
antimatter in, 17: 6915(T)
dosimetry and biological effects in stratosphere, 17: 5765 (AFCRL-62-244)
effects on plant growth, structure, and adaptation, 17: 5781(T) (FTD-TT-62-771)
electron production in ionospheric D layer by, 17: 6927
excitation of forbidden emission lines in oxygen, 17: 6903
flux measurements in class 3+ flare, 17: 6921
Forbush decrease measurements, 17: 6929
hazards of heavy primary, in space, 17: 6305 (BNL-6501)
intensity increase coincident with sudden commencement of geomagnetic storms, 17: 6928
intensity of, geographical position of line of minimum, 17: 6938(T)
reactions with nuclei, electron production in, 17: 6939
COSMIC-RAY SPECTRA
detection and measurement of heavy primary, 17: 6931
COSMIC SHOWERS
distribution in jets from 10^{13}-ev primary, 17: 6919
COSMOLOGY
gravitational changes in, terrestrial effects of, 17: 6300
neutrino electrodynamics in models of, 17: 7005
CREATINE
radiation effects on content in erythrocytes, 17: 5856
CRITICAL ASSEMBLIES
analysis of aluminum–plutonium-water, applicability of Westcott scheme in, 17: 7549(R) (HW-74761(p.5.1-35))
control rod theory for homogenized, 17: 7581
design and hazards summary of PWAC, at CANEL, 17: 7566 (PWAC-170)
dosimetry of Los Alamos Godiva II, 17: 5774 (TID-13984)
CRITICALITY STUDIES
interaction of fissionable units, technique for computing, 17: 6942 (TID-15342)
nuclear properties of reactor systems with variable mixtures of heavy water and water as moderator, 17: 5656(R) (KR-29)
CROSS SECTIONS
threshold effects in average, according to R-matrix theory, 17: 7236
CRYSTAL STRUCTURE
defects in, interactions with phonons, 17: 6800 (TID-15495)
electron-phonon interactions in, dispersion in, 17: 6892
virtual localized lattice modes in, detection by Mössbauer effect, 17: 6879
CRYSTALS
effects of defects in, on attack by catalysts, 17: 6679 (TID-15270)
gamma resonance absorption by impurity nuclei in, 17: 6854
neutron diffraction by, experiments on, 17: 7068
neutron diffusion equilibrium in, thermal, 17: 7129 (NP-12330(p.378-83))
phonon transitions in, theory of multi-, 17: 6887(T)
structure of, for use in neutron monochromatization, x-ray diffraction studies of, 17: 6058(T) (AEC-tr-5566)
structure of, mosaic, 17: 6644 (BLG-132)
CUPFERRON
solvent properties for zirconium in molybdenum and tungsten, 17: 6012
CURIE UNITS
definition, 17: 5660
CURIUM
separation from chloride solutions by solvent extraction using mono-2-ethyl hexyl phosphoric acid, synergistic effects in, 17: 6188 (TID-15271)
separation from nitrate solutions by ion exchange, comparison with other actinides, 17: 6182 (IA-783)
CURIUM ISOTOPES Cm-243
alpha particle–gamma ray angular correlations in, 17: 7219
CUTTING TOOLS
design for heat-resisting alloys, 17: 6619
design of broach for high-strength steel and heat-resisting alloys, 17: 6621
design of broach for high-strength steel and heat-resisting alloys, 17: 6622
design of broach for René 41 turbine wheels, 17: 6623
CYANIDES
oxidative effects on metabolism in *Staphylococcus aureus* and its radio-induced mutant, 17: 5790(T)
CYCLOHEXANE
behavior of pyrene in, effects of concentration on, 17: 5938 (TID-13249)
C_6H_{11}–$C_{12}H_{11}$, diffusion of toluene in, 17: 6060
C_6H_{11}–C_6H_{11}, diffusion of toluene in, 17: 6060
CYCLOHEXANOL
dehydration of, radiation effects on catalysis of, 17: 6511(R) (BMI-1593(Del.))
CYCLOHEXANONES
solvent properties for tantalum and titanium, 17: 6022
CYCLOPENTADIENE
radioinduced polymerization at –78°C, effects of ammonia on, 17: 6149
reactions with maleic anhydride, secondary deuterium isotope effects in, 17: 6122
CYCLOPROPANE
cyclopropane–platinum chloride, with recoil tritium atoms, 17: 6087
CYCLOTRON RADIATION
emission of decameter, by Jupiter, 17: 6912
CYCLOTRONS
beam accelerator and extraction, 17: 7359
beam characteristics of Analogue II, 17: 7399
beam extraction from radial ridge, 17: 7402
beam extraction system for Berkeley 88-inch, 17: 7404
beam extraction system for Berkeley 88-in., 17: 7405

beam handling system for Univ. of Mich., 17: 7367
beam handling system of Berkeley 88-inch, 17: 7409
beam orbits in AVF, analog computer programs for, 17: 7388
beam phase measurement of 88-in., at Berkeley, 17: 7349 (UCRL-10070)
beam production in spiral ridge, spill, 17: 7356
building and services for Berkeley 88-inch, 17: 7414
comparison with variable-energy synchrocyclotron, 17: 7379
conference on sector-focused, Los Angeles, April 1962, 17: 7352
construction of trim-coils for Berkeley 88-inch, 17: 7407
costs for 88-inch Berkeley, 17: 7415
design computations for isochronous, 17: 7395
design concepts for large isochronous, 17: 7396
design criteria for 700 Mev, 17: 7398
design features of spiral ridge, 17: 7355
design features of Univ. of Colorado, 17: 7358
design features of Philips AVF, 17: 7363
design features of Univ. of Mich., 17: 7364
design features of 22-inch spiral ridge, 17: 7370
design for 450 Mev spiral ridge, 17: 7397
design of dee for Univ. of Colorado, 17: 7408
design of ion source for Berkeley 88-inch, 17: 7406
design of UCLA spiral-ridge, 17: 7353
design of Univ. of Milan, 17: 7361
design studies for 70-inch versatile, 17: 7369
dissociation of negative hydrogen ions in, 17: 7360
frequency modulation with ferroelectric crystals, 17: 7413
geometry of center region in Berkeley, 17: 7389
ion source mechanism for Berkeley 88-in., 17: 7348 (UCRL-10068)
magnet coil settings for Analogue II, 17: 7400
magnetic cone for center of Berkeley, 17: 7390
magnetic field design for Univ. of Colorado, 17: 7372
magnetic field measurements on 88-in., design of probe for, 17: 7350 (UCRL-10085)
magnetic field measurements on Berkeley, 17: 7373
magnetic field measurements for AERE spiral ridge, 17: 7374
magnetic field shaping for Univ. of Manitoba, 17: 7368
magnetic field shape calculations for AVF, 17: 7387
magnetic field shimming of isochronous, 17: 7362
magnetic fields of Univ. of Mich., 17: 7365
magnetic trim-coil currents for, computer programs for, 17: 7386
neutron production for biological experiments in, control of, 17: 6315 (ORNL-1559)
operation of isochronous, duty factor increase, 17: 7411
operation of radial ridge, 17: 7354
orbit stability in sector-focused, effects of fields on, 17: 7383
particle orbits in AVF, 17: 7381
particle orbits of, computer programs for, 17: 7384
power supplies for 88-inch, silicon diode application to, 17: 7412
proposal for sector-focused, 17: 7394
proton beam extraction from Univ. of Ill., 17: 7403
r-f system mechanical features for Berkeley 88-in., 17: 7347 (UCRL-10065)
radiation survey at LRL 184-inch, 17: 7401
radiofrequency system for Univ. of Mich., 17: 7366
radiofrequency system for UCLA, 17: 7377
radiofrequency system for Berkeley, 17: 7378
radiofrequency system for ORNL 86-inch, 17: 7380
specifications for fixed-frequency AVF, 17: 7371
stability in sector-focused, 17: 7382

CYLINDERS
deformation, 17: 6207 (TRG-Report-294)
neutron flux distributions in, 17: 7062
radiation effects on strength of thick-walled, 17: 6754(T) (FTD-TT-62-719)
thermal stress in, 17: 6247 (TID-17498)

CYTIDINE
desoxy, radiation chemistry of tritium-labeled, 17: 5675(R) (LAMS-2780 (p.246-317))

CYTOLOGY
of vaginal cells in evaluation of effectiveness of radiotherapy of gynecologic cancer, 17: 5864
radiation effects on chromosomes, reaction mechanisms, 17: 5875
radiation injury in cell populations, kinetics, 17: 5876

D

DAREX PROCESS
development of, status review of, 17: 6186 (ORNL-TM-420)

DATA RECORDING SYSTEMS
design and operation of automatic, for foil-activation data, 17: 6494 (ANL-6628)
design and performance of 25-input pulse-height, 17: 6423

DECANE
determination in kerosene by vapor-phase chromatography, 17: 6195
C_8H_{17}–$C_{10}H_{21}$, diffusion of toluene in, 17: 6060

DECAY SCHEMES
ionization caused by sharp change in charge in, effect of nuclear recoil on, 17: 7154

DECONTAMINATING SOLUTIONS
corrosive effects of, in reactors, 17: 6588

DECONTAMINATION OF EQUIPMENT
procedures during Operation Hardtack, 17: 6317 (OTO-58-3)

DECONTAMINATION OF PERSONNEL
procedures during Operation Hardtack, 17: 6317 (OTO-58-3)

DEUTERIUM
absorption of, by titanium, 17: 6699(T) (SCL-T-451)
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
exchange by diazo-acetyl compounds, 17: 6067
exchange with hydrogen, radiation effects on catalytic properties of magnesium oxide for, 17: 6086
isotope effects on hydrogen bonding of fluoroform to tetrahydrofuran, 17: 6120
isotope effects on acid-catalyzed hydrogen exchange in 1,3,5-trimethoxybenzene, 17: 6121
mesons (π^0) photoproduction in, 17: 7036
neutron scattering at 0.5 to 1.95 Mev, differential cross section and polarization of, 17: 6777(R) (ANL-6603(p.9-19))
properties of liquid and solid, measurement of kinetic, 17: 6103
reactions with molecular deuterium ions at 3.5 to 100 kev, cross sections for dissociation, 17: 6896

DEUTERIUM HYDRIDES
properties of liquid and solid, measurement of kinetic, 17: 6103
D_s–DH, kinetic properties of liquid and solid, 17: 6103
DH–H_s, kinetic properties of liquid and solid, 17: 6103
DH–He, kinetic properties of liquid and solid, 17: 6103
HD–H_s, isotope shift in nuclear magnetic resonance spectra of, 17: 6066

DEUTERIUM IONS
reactions of molecular, with deuterium at 3.5 to 100 kev, cross sections for dissociation, 17: 6896

DEUTERIUM SYSTEMS
D_s–DH, kinetic properties of liquid and solid, 17: 6103
D_s–H_s, kinetic properties of liquid and solid, 17: 6103
D_s–He, kinetic properties of liquid and solid, 17: 6103

DEUTERON BEAMS
production in radial ridge cyclotron, 17: 7354

DEUTERONS
acceleration in proton synchrotrons, feasibility of, 17: 7335 (BNL-6511(p.289-93))
field-theoretic properties of, anomalous threshold of vertex function, 17: 6964
interactions with neutrons, scattering lengths for, 17: 7089 (NP-12330 (p.15-16))
interactions with protons and tritons, neutron spectra from, 17: 7241
photoemission from light nuclei, mechanisms in, 17: 7185
production by proton reactions with aluminum, beryllium, and iron at 30 Bev, 17: 7259
production of, from proton bombardment of nuclei at 25 to 30 Bev, 17: 7258
reactions (d,n) with neon-20 and -22, 17: 7170
reactions (d,p) with carbon-12 at 0.8 to 1.2 Mev, proton polarization in, 17: 7271
reactions (d,p) with light and medium nuclei, polarization of protons from, 17: 7286

reactions (d,p) with nitrogen-14, angular distribution and excitation curves for, 17: 7159
reactions (d,p) with boron-11, 17: 7165
reactions (d,p) with nuclei, applications of polology to, 17: 7255
reactions (d,t) with nuclei, 17: 6780(R) (ANL-6603(p.52-5))
DIAMONDS
radiation effects on properties of, 17: 6751 (TID-17406)
DIELECTRICS
ionization in, methods for detection of, 17: 6412(T) (SCL-T-447)
radiation emission by uniformly rotating point charges in, 17: 6797 (PIBAL-753)
sealing of, to metals, 17: 6676(R) (RADC-TDR-62-401)
DIET
effects of phosphorus-deficient, on elimination of strontium-90 from mice, 17: 5717
effects on iodine-131 release by thyroid gland, 17: 5723
radioactivity levels in British, 17: 6336
DIFFERENTIAL EQUATIONS
solutions for linear, extrapolation procedure for obtaining, 17: 6502 (TID-14532)
DIODES
use of tunnel, in ternary computers, 17: 6501 (TID-14155)
DISASTERS
casualty assessment following neutron exposure, 17: 5775 (TID-14529)
dose inhaled after reactor accident, measurement, 17: 6327
treatment of radiation injuries, 17: 6325(T) (JPRS-16072)
DISSOCIATION
thermodynamic function calculation for solids from, 17: 6108
DISSOLVERS
development of corrosion-resistant alloys for, for reactor fuel dissolution, 17: 6566 (HW-SA-2307)
DISTILLATION APPARATUS
design for radiochemical separation of metals, 17: 6135
DISULFIDES
effects of photochemical reactions of benzophenone with 2-propanol, 17: 6146
DODECANE
determination in kerosene by vapor-phase chromatography, 17: 6195
DOGS
analysis for chloride in fluids and tissues in, by isotope dilution, 17: 5999
blood flow in carotid arteries in, tracer study using double collimator, 17: 5732
DOORS
production of steel shielding, 17: 7504
DRUGS
effectiveness in treatment of radiation sickness, 17: 5918
therapeutic effects of *Aralia* and *Rostharrow* in radiation sickness, 17: 5927
DYSPROSIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
separation from rare earths, 17: 6019
DYSPROSIUM ISOTOPES
alpha decay systematics for, 17: 7199
DYSPROSIUM ISOTOPES Dy^{-160}
energy levels of deformed, lifetimes of, 17: 7292
DYSPROSIUM OXYTELLURIDES
preparation and properties, and crystalline structure, 17: 6068

E

EARTH
cosmological effects on, from gravitational changes, 17: 6300
thermal properties of, models and theories for, 17: 6294
ECOLOGY
of plants, effects of atomic explosions at Nevada Proving Grounds Area, 17: 5655 (HW-SA-2546)
EINSTEINIUM
separation from nitrate solutions by ion exchange, comparison with other actinides, 17: 6182 (IA-783)
ELASTOMERS
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
ELECTRIC ARC FURNACES
tungsten electrode burn-out in, 17: 6601(T,R) (EURAEC-372)
ELECTRIC ARCS
characteristics of, as ion sources for space propulsion uses, 17: 6900
design of triggered spark gap, for synchrocyclotron beam deflector, 17: 7344 (CERN-62-25)
electric conductivity of plasma in, device for measuring, 17: 7493
plasma instabilities in, review, 17: 7490
ELECTRIC CONDENSERS
collector system for, 17: 6397 (JUL-72-PP)
construction of banks of, with low inductivity, 17: 6396 (JUL-71-PP)
ELECTRIC CURRENTS
quantized magnetic flux with, 17: 6804 (UCRL-6630-T)
ELECTRIC DISCHARGE
breakdown in perpendicular magnetic field, time lag of, 17: 6821
electron density in gaseous, measurement of, 17: 7437
electron distribution function in high-frequency, 17: 7451
evolution of positive, to breakdown, 17: 7575(T) (CEA-tr-A-1125)
in argon, magnetic field effects on light characteristics of pulsed, 17: 7486
microwave plasma diagnostics in hot-cathode, 17: 7452
plasma motion in toroidal, effects of transverse magnetic field on, 17: 7445
plasma properties in linear capacitative, 17: 7449
striations in h-f, mechanisms for standing, 17: 7444
ELECTRIC FIELDS
electric discharge breakdown in, with perpendicular magnetic field, 17: 6821
fluctuations in electron plasmas, 17: 7473
measurement in space charge sheath between low pressure plasma and insulated wall, 17: 7476
ELECTRIC GENERATORS
characteristics of magnetohydrodynamic, 17: 6817
ELECTRIC INSULATORS
radiation effects, 17: 6381 (AD-254402)
ELECTRIC METERS
design of resistivity, for impurity determination in liquid metals, 17: 6382 (APDA-149)
ELECTRIC POWER
needs and sources in EURATOM countries, survey, 17: 5659
ELECTRIC PROBES
use for measuring fields of cyclotron magnets, 17: 7350 (UCRL-10085)
ELECTRICITY
materials used in, research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
ELECTRODYNAMICS
book: *Electromagnetic Waves*, 17: 7052
ELECTROLYTES
concentration in internal diseases, 17: 5694
ELECTROMAGNETIC FIELDS
charged particle interactions in, macroscopic electrostatic and magnetostatic energy in, 17: 6834
deformation of moving, 17: 6811(T) (FTD-TT-62-981)
intensity effects of sinusoidal, on behavior of charged particles, 17: 6816
ion drift velocity in, effect of charge exchange on, 17: 7426 (MATT-92)
ELECTROMAGNETIC PUMPS
performance of, for pumping potassium–sodium alloy at 1500°F, 17: 7606(R) (ORNL-1515)
ELECTROMAGNETIC WAVES
attenuation in an inhomogeneous medium related to transition radiation, 17: 7029
book: *Electromagnetic Waves*, 17: 7052
emission by electrons in synchrotron, 17: 6792(R) (ISS 62/14)
emission in homogeneous media by high-energy charges, 17: 7038
interactions with bounded anisotropic plasma, 17: 7421 (AFCRL-62-186)
interactions with free electrons, 17: 7114 (NP-12330(p.172-8))
measurement in plasma, design of instrumentation for, 17: 7420 (AD-275005)
propagation in multicomponent plasma, Poynting vectors of, 17: 7438

ELECTROMAGNETISM
book: *Electromagnetic Waves*, 17: 7052
ELECTRON BEAMS
characteristics in Analogue II cyclotron, 17: 7399
control of, in electron-beam furnace, 17: 6226(P)
injection in plasma, equilibrium solutions for, 17: 7424 (DCAS-TDR-62-42)
model for sheet, derivation of "water-bag", 17: 7450
propagation of transverse waves by, 17: 6801(R) (TID-17303)
ELECTRON MICROSCOPY
use of, for examination of irradiated ceramic materials, 17: 6657 (HW-SA-2550)
use of, in radiation damage examination, 17: 6746 (MRL-126)
ELECTRON PAIRS
annihilation of, formation of meson (μ) pairs in, 17: 7031
production by low-energy photons on nuclei, 17: 7304
spectrum of, from neutron capture in gadolinium, 17: 7182
ELECTRON PHOTOGRAPHY
intensity determinations in conversion lines, 17: 6823
ELECTRON SHOWERS
production by mesons (μ) at high energies, 17: 7044
ELECTRON SOURCES
development of cesium, 17: 6788(R) (EDR-2791)
ELECTRONIC EQUIPMENT
book: *Electronic Equipment in Nuclear Physics*, 17: 6426
design of CERN 19-in. chassis system, 17: 6388 (CERN-62-29)
radioactivity of head amplifier components, 17: 6415
ELECTRONICS
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
ELECTRONS
attachment and solvation in gamma irradiated organic glasses at −196°C, 17: 6148
avalanches of, use of multistage image intensifier for photographing, 17: 7018
bremsstrahlung emission by 3.5-Mev, polarization of, 17: 7112 (NP-12330 (p.162-5))
bremsstrahlung spectrum of, high-frequency region of, 17: 6983
bremsstrhalung emission by transversely polarized, photon asymmetry in, 17: 6978
capture by molecules, theory of dissociative attachment in, 17: 6862
collisional excitation of atoms and ions in stellar atmosphere, 17: 6905
coupling effects on dissociation and energy-transfer of molecules, 17: 6151
density in plasma, measurement of, 17: 7437
density in space near earth, 17: 6909
detachment from hydrogen by magnetic fields, 17: 6880
diffusion in h-f discharge plasma, striations from, 17: 7444
diffusion in the radiation belts, 17: 6930
diffusion in Van Allen belt of high mirror point, 17: 6924
diffusion in Van Allen belt of low mirror point, 17: 6925
distribution and temperature of, in plasma regions of thermionic converters, 17: 7419 (AD-274920)
distribution in the ionosphere, ground-based measurement of, 17: 6774 (AFCRL-531(I))
emission from a clean surface of molybdenum by bombardment with low-energy noble gas ions, 17: 6855
emission from solids after excitation, review of, 17: 6789 (ERDL-1704-RR)
emission of exo-, effects of positive-ion bombardment of emitter on, 17: 6831
emission of secondary, theory of, 17: 6832
energy distribution of, ejected from tungsten by helium ions, 17: 6853
energy relaxation in solids, theory of, 17: 6075
field fluctuations in plasma of, turbulent, 17: 7473
interactions of, mesons (μ) production by electromagnetic, 17: 7009
interactions with protons, two-photon exchange in, 17: 7017
interactions with protons taking into account dipole moments, 17: 7050
interactions with phonons, dispersion in, 17: 6892
interactions with electromagnetic waves, 17: 7114 (NP-12330(p.172-8))
interactions with electrons and positrons, cross sections for, 17: 7117 (NP-12330(p.193-8))
microwave emission in solar corona, 17: 6906
motion in plasma, review of collective, 17: 7490
production in D layer by cosmic radiation, 17: 6927
properties of Argus injected shell in geomagnetic field, 17: 6839
removal from gaseous plasma by refractory dust particles, 17: 7467
scattering by atoms or molecules, effects of negative-ion states on theory of, 17: 7076 (BNL-5801)
scattering by helium, variational calculations for elastic, 17: 7507
scattering by light nuclei at 41.5 Mev, magnetic elastic, 17: 7222
scattering by nuclei, theory of relativistic Coulomb, 17: 7520
scattering by nuclei, cross sections for EO transitions in, 17: 7269
scattering by nuclei, Green's functions and optical potential analysis of elastic, 17: 7187
single-particle excitations in a dense system of, containing a positive point charge, 17: 6991
synchrotron radiation emission by high-energy, polarization of, 17: 7418
velocity distribution, possibility of non-Maxwellian, 17: 6830
ELECTROSTATIC FIELDS
mechanical features of cyclotron beam extraction system, 17: 7405
ELECTROSTATIC GENERATORS
development of high-voltage, with stability of 10^{-4}/min, 17: 6384 (CEA-2143)
ELECTROSTATIC LENSES
focus and image shape of three-electrode and four-electrode, 17: 6810(T) (CEA-tr-X-477)
ELECTROSTATIC PRECIPITATORS
design of airborne, 17: 6314 (NP-12386)
ELEMENTARY PARTICLES
classification and properties, 17: 6972
detection using bubble chambers, effects of pressure on, 17: 6472
Feynman amplitudes for nonrelativistic processes, 17: 7524
interactions and properties of non-leptonic, model for, 17: 7016
interactions at high energies, application of Regge poles to, 17: 7513
interactions of, amplitude attenuation in, 17: 6894
interactions of, analytic approximation to the low-energy solutions of inverse amplitude dispersion relations in, 17: 7510
interactions of, classification of, 17: 7011
interactions of, experimental possibility of verifying hypotheses regarding the nature of resonances in, 17: 7048
interactions of, lectures on theory of weak, 17: 6962(T) (AEC-tr-5226)
interactions of, neutral current and neutrino theory in, 17: 7037
interactions of, overlapping final-state, 17: 6994
interactions of, relation between binding energy and coupling, 17: 6943 (BNL-5517)
interactions of, theory of quantization of baryon number and hypercharge in, 17: 6946 (BNL-5726)
interactions of, wave functions and signal propagation for, 17: 6951 (JINR-P-1091)
mass gauge invariance of, 17: 7015
mass levels and resonance states of, 17: 7012
phase volume of n-particle systems, calculation of invariant, 17: 7030
production in nucleon interactions at high energies, azimuthal angular distribution of, 17: 7019
quantum statistics of interacting, isobaric scheme for, 17: 6967
reactions with nuclei at high energies, 17: 7186
relativistic field theoretical equations for, 17: 6963
rotator model of, considered as relativistic extended structures in Minkowski space, 17: 6981
scattering amplitude, Born series for non-relativistic elastic, 17: 6973
scattering amplitudes in complex angular momentum plane, 17: 6974
scattering by black nucleus, cross sections for elastic, 17: 7205
scattering by nuclei, variational calculations for elastic, 17: 7507
scattering by nuclei, cross sections for, 17: 7184
scattering of, moving pole theory in, 17: 7004
space-time model of relativistic extended, in Minkowski space, 17: 6982
ELEMENTS
atomic weights of, based on carbon-12, 17: 6072
spectra of, experimental gf values in, 17: 6824
EMBRYOS
radiation effects on development of mice, 17: 5897
radiation injuries in chick, protective effects of adenosine triphosphate and diphosphopyridine nucleotide, 17: 5914
ENANTHIC ACID, ETHYL ESTER

radiation effects in urea inclusion compound of, 17: 6162
ENGLAND
nuclear power development in, 17: 5664
ENZYMES
radiation effects, reaction mechanisms, 17: 5767 (BNL-5727)
radiosensitivity of lysine decarboxylase in *Bacterium cadaveris*, 17: 5829
reaction mechanisms of, in food processing, 17: 5696
separation of labeled and unlabeled β-galactosidase, by equilibrium density gradient sedimentation, 17: 5710
ERBIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
separation from rare earths, 17: 6019
spectra of, effect of transitions in 4f shell on absorption, 17: 6099
ERBIUM ISOTOPES Er-164
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
ERBIUM ISOTOPES Er-166
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
ERBIUM ISOTOPES Er-168
energy levels of, gr factor of 2^+-rotational, 17: 7270
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
ERBIUM ISOTOPES Er-170
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
ERYTHROCYTES
analysis of human and chicken for subpopulations, 17: 5673(R) (LAMS-2780(p.181-210))
radiation effects on creatine content in, 17: 5856
radioinduced changes in, correlation with leukopenia in acute radiation sickness in rabbits, 17: 5853
radiosensitivity of metabolism, 17: 5843
ERYTHROPOIESIS
effect of thyroxine on, in irradiated rats, tracer study, 17: 5883
ESCHERICHIA COLI
lethal effects of beta particles from incorporated tritium, 17: 5793
radiation injuries, protective effects of cysteamine, 17: 5932
radioinduced denaturation of desoxyribonucleic acid *in vitro*, 17: 5855
radiosensitivity, effects of oxygen, 17: 5878
ETHANE
chemical effects on work function of iridium surface, 17: 6660 (IS-462)
ETHANE, HEXABROMO-
radiation and thermal effects on bromine-82 production in solid, 17: 6150
ETHANE, IODO-
radiolysis of, in gas phase, 17: 6130 (RRL-78T)
ETHANETHIOL, 2-AMINO-
protective effects against whole body x irradiation in rats, 17: 5858
protective effects against radiation injury to brain, 17: 5886
protective effects against radiation injuries in mice, 17: 5924
protective effects against radiation injury in *Escherichia coli*, reaction mechanisms, 17: 5932
ETHANOL
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
radiation effects on reactions with hydroxyl radicals in ferri- and ferrocyanide solutions, 17: 6165
radiolysis of glassed, electron attachment and solvation at −196°C in, 17: 6148
ETHER, BIS(2-BUTOXYETHYL)
determination in kerosene–tributyl phosphate mixtures by infrared absorption spectrometry, 17: 5975 (PG-Report-414)
ETHYL ACETATE
dissociation and rearrangement of deuterated, under electron impact, 17: 6164
ETHYL ETHER
alcohol-diethyl ether-ketone, effects of composition on chromatographic separation of rare earths, 17: 6009
ETHYL FORMATE
dissociation and rearrangement of deuterated, under electron impact, 17: 6164
ETHYLAMINE, 2,2'-DITHIOBIS-
protective effects against radiation injury in yeast cells, 17: 5719
ETHYLENE
chemical effects on work function of iridium surface, 17: 6660 (IS-462)
radioinduced polymerization of acrylonitrile and, yield from, 17: 6166
reactions with hydrogen atoms, 17: 6071
reactions with hydrogen atoms, 17: 6145
use of carbon-14-labeled, for measuring radical yields in radiolysis of hydrocarbons, 17: 6144
ETHYLENE, CHLORO- POLYMERS
particle scattering by VYNS, energy-loss spectra from, 17: 7157
ETHYLENE, TETRAFLUORO- POLYMERS
properties as dropping mercury electrodes for glass-corroding media, design, 17: 5987
ETHYLENIMINE
genetic effects on tomatoes, 17: 5892
EUROPE
uranium deposits in, survey of, 17: 6292
EUROPIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
determination in rare earth oxides, 17: 6019
determination in thorium by spectral analysis, 17: 6021
separation from gadolinium and tin by ion exchange, 17: 7125 (NP-12330 (p.253-7))
separation from rare earths, 17: 6019
spectra in molybdates and tungstates, intensities of emission, 17: 6837
EUROPIUM CHELATES
with 2-hydroxybenzophenone, emission spectra, 17: 6085
EUROPIUM ISOTOPES
alpha decay systematics for, 17: 7199
EUROPIUM ISOTOPES Eu-147
alpha and beta decay schemes of, 17: 7150
EUROPIUM ISOTOPES Eu-148
alpha decay scheme of, 17: 7150
decay scheme, 17: 7181
EUROPIUM ISOTOPES Eu-149
alpha decay scheme of, 17: 7150
EUROPIUM ISOTOPES Eu-150
beta decay scheme of, 17: 7150
EUROPIUM ISOTOPES Eu-152
beta decay of metastable, 17: 7287
beta-gamma circular polarization correlation for, 17: 7107 (NP-12330 (p.137-40))
decay of, E2 and K conversion coefficients in, 17: 7203
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
nuclear spin and parity of metastable, 17: 7287
EUROPIUM ISOTOPES Eu-154
beta decay of, non-unique first-forbidden, 17: 7106 (NP-12330(p.132-6))
EUROPIUM ISOTOPES Eu-156
decay, 17: 7108 (NP-12330(p.141-6))
EUROPIUM OXIDES
hydration resistance of, containing titanium dioxide, 17: 6664 (MND-M-2346)
stabilization of, using titanium dioxide, 17: 6664 (MND-M-2346)
Eu_2O_3–stainless steel, properties of cermets of, 17: 6664 (MND-M-2346)
EUROPIUM OXYTELLURIDES
preparation and properties, and crystalline structure, 17: 6068
EVAPORATORS
description of vacuum, for deposition of thin films, 17: 6158
EXPERIMENTAL BOILING WATER REACTOR
design modifications for operation at 100 Mw(t), 17: 7612 (TID-14697)
EXPERIMENTAL GAS COOLED REACTOR
moderator oxidation studies for evaluation of combustion hazards in depressurization accident, 17: 7554(R) (HW-74761(p.10.1-6))
EXPLODING WIRE PHENOMENA
energy measurement using vacuum calorimetry, 17: 6425
plasma from, destructive effects of, 17: 7495
EXPLOSIONS
of thread-like channel of ionized gas, luminous phenomena accompanying, 17: 7443

EXPLOSIVES
creep testing of, equipment for, 17: 6242 (AWRE-O-34/62)
EXTENSOMETERS
development for in-reactor creep measurements, 17: 7553(R) (HW-74761 (p.9.1-37))
EXTRACTION APPARATUS
operation of counter-current liquid-liquid, 17: 6178 (AERE-R-4091)
EYES
detection of cosmic ray mesons (μ) by human, 17: 6932
radiation effects from therapeutic doses, 17: 5794

F

FALLOUT
computations of close-in for one megaton burst, 17: 6307 (CDRP-182-112)
deposition computations for, 17: 5749 (CDRP-182-113)
diffusion and dispersion in atmospheric aerosols, 17: 6285
fall velocity of particles, measurement, 17: 6303 (AD-276121)
food contamination by, protection from harmful effects of, 17: 6338
geochemistry of stratospheric, 17: 6272(R) (ORO-520)
monitoring in Austria, 1961, 17: 6346
monitoring in Japan, 1960 to 1962, 17: 5691
monitoring in Portugal, spring 1960, 17: 6354
monitoring in Portugal, 1960, 17: 6355
monitoring in Portugal, 17: 5740
monitoring in Sweden, 1961, 17: 5763 (AE-80)
monitoring of, during Operation Hardtack, 17: 6317 (OTO-58-3)
monitoring of, in New Zealand, 17: 5750(R) (DXRL-F6)
monitoring system intercalibration, 17: 5753 (NRL-5850)
monitoring, 1959 to 1960, 17: 5760
monitoring, 1959 to 1962, 17: 5761
protection from, 17: 6317 (OTO-58-3)
radiation hazards to U. S. children, 1962, 17: 6350
radiation hazards to human populations, 17: 5760
radiation hazards to human populations, 17: 5761
radiation monitoring of, in New Zealand rain water, 17: 5758
radioactive contamination levels resulting from a single detonation, statistical analysis, 17: 6306 (CDRP-182-105)
radioisotope levels in, 17: 5751(R) (HASL-132)
sampling of, in stratosphere, 17: 6271(R) (NYO-10464)
FAST NEUTRONS
activation analysis with, parameters of, 17: 6026
biological effects, effects of dose on recovery rate, 17: 5909 (TID-14019)
biological effects in mice, effects of previous exposure, 17: 5776 (TID-14698)
biological effects in mice, 17: 5671(R) (LAMS-2780(p.85-129))
cross sections for 14-Mev, measurement of total, 17: 7095 (NP-12330 (p.61-5))
detection and measurement using helium-3-filled semiconductor counter, 17: 6481
detection of, efficiency of filament scintillator for, 17: 7118 (NP-12330 (p.199-201))
dosage determinations in biological experiments, 17: 6315 (ORNL-1559)
dosage determinations, around human phantoms by nuclear emulsions, 17: 6323 (UCRL-9967)
dosimetry of, comparison of methods for, 17: 6480
fission cross sections for uranium-234, 17: 7204
polarization by copper and zirconium, measurement as function of scattering angle, 17: 7065
polarization by ice-d, and oxygen (liquid), 17: 7064
polarization of (d,t), using polarized deuterons, 17: 7066
reactions (n,α) with indium and phosphorus, 17: 7094 (NP-12330(p.46-52))
reactions (n,p) with molybdenum isotopes, cross sections for, 17: 7101 (NP-12330(p.97-103))
reactions on nuclei, activation cross sections for, 17: 7306
reactions with aluminum, alpha, neutron, and proton spectra from, 17: 7093 (NP-12330(p.39-45))
reactions with sodium in phantom, 17: 5736
reactions with uranium-238, alpha emission in fission, 17: 7097 (NP-12330(p.71-8))
scattering of 14-Mev, cross sections for nonelastic, 17: 7096 (NP-12330 (p.66-70))
scattering of 84-Mev, semiclassical optical model for, 17: 7266
FAST REACTORS
design study of plutonium-fueled, for spacecraft applications, 17: 7551(R) (HW-74761(p.7.1-28))
fission product behavior in liquid-metal-cooled, 17: 7611 (TID-14495)
fuel elements for, evaluation of high-exposure plutonium as, 17: 7551(R) (HW-74761(p.7.1-28))
fuel value of plutonium oxide in, 17: 7545 (HW-72304)
FATIGUE
thermal, determination of, 17: 6674 (ORNL-TM-405)
FATTY ACIDS
radiation effects on synthesis of, in liver in rats, 17: 5792
radiation effects on skin, 17: 5825
transport in small intestines of rats, radiation effects on, 17: 5933
FECES
analysis for gamma emitting isotopes in, comparison of methods for, 17: 5734
FERMI FAST BREEDER REACTOR
criticality studies, 17: 7563(R) (PRDC-TR-59)
development and operation, 17: 7608(R) (PRDC-TR-60)
instrumentation and systems development, 17: 7563(R) (PRDC-TR-59)
shielding test program, 17: 7563(R) (PRDC-TR-59)
testing atmosphere contamination during maintenance, 17: 7563(R) (PRDC-TR-59)
FERMIONS
calculation and application of the density propagator for a self-bound system of, 17: 6989
energy of system of, corrections to Goldstone perturbation expansion of, 17: 6497 (NP-12304)
interacting systems of, singularity of t-matrix of, 17: 7006
interactions with fermions, 17: 7042
interactions with a gravitational field, 17: 7049
properties of the one-particle Green's function for nonuniform systems of, 17: 6990
quantum statistical mechanics of systems of, with several components, 17: 7511
Sampson-Seitz procedures and the static responses of normal systems of, 17: 6992
FERRATES
ferromagnetic resonance of, methods of measuring, 17: 6042 (NOL-TR-62-34)
FERRITIN
molecular structure of, electron microscope studies, 17: 6792(R) (ISS 62/14)
FERROMAGNETIC MATERIALS
superconductivity of, ultra-high-field realization in, 17: 6873
FETUSES
analysis of body fluids for calcium, strontium, and other elements, 17: 5731
FFAG ACCELERATORS
design of beam transport system for 10-Bev proton, 17: 7336 (BNL-6511(p.294-302))
injector design for 10-Bev, 17: 7315 (BNL-6511(p.76-97))
FIBRINOGEN
radiation effects, thromboelastographic and electrophoretic study, 17: 5799
FIELD THEORY
causality in, 17: 6951 (JINR-P-1091)
causality in, 17: 6793 (JINR-P-1090)
classification of interactions, 17: 7011
elementary particles in, model for non-leptonic, 17: 7016
gauge group and symmetries of the isospace associated with non-relativistic rotator, 17: 6970
gravitational changes in, terrestrial effects of, 17: 6300
gravitational interaction of fermions, 17: 7049
mass of a complex vector field, 17: 7519
potential scattering in, fundamental relations for, 17: 7506
quantum, space-time approach to, 17: 7514
relativistic particle equations in unified Hamiltonian, 17: 6963

role of short-range three-particle forces in processes with the generation of three particles near threshold, 17: 7518
scattering amplitudes in, parametric representations of, 17: 6965
theory of quantization of baryon number and hypercharge, 17: 6946 (BNL-5726)
three-body problem for short-range forces in the linear approximation in the force range, 17: 7517
vertex function of deuterons in, anomalous threshold of, 17: 6964

FILMS
deposition of, description of vacuum evaporator for, 17: 6158

FILTER PAPERS
use for sampling airborne iodine isotopes, 17: 5754 (PG-Report-408)

FILTERS
design for monitoring radioactive aerosols, 17: 6287

FINNED TUBES
fabrication of helical beryllium, 17: 6599 (TID-17340)

FISH
beta activity measurement from, 17: 5972 (PG-Report-403)
force-feeding method for administering radioisotopes, 17: 5738
iodine-131 uptake by, in surface water, 17: 5757
pathological effects of ingestion of strontium-90 plus yttrium-90, 17: 5701 (HW-SA-2255)
strontium metabolism, tracer study, 17: 5708(T) (IPRS-15871)

FISSION
alpha emission in fast, 17: 7097 (NP-12330(p.71-8))
kinetic energy of fragments emitted in subbarrier, 17: 7300
mechanisms in thermal neutron, 17: 7098 (NP-12330(p.79-85))
of heated nuclei, angular anisotropy of fragments from, 17: 7301
of rotating nuclei, theory of, 17: 7298

FISSION CHAMBERS
design and performance for thermal neutrons, 17: 6467

FISSION PRODUCTS
analysis of gaseous, design of in-pile apparatus for use in, 17: 6202 (BMI-X-216)
angular anisotropy of, from a heated nucleus, 17: 7301
angular distributions in uranium-234 fission to 4 Mev, 17: 7204
behavior in liquid metal cooled reactors, 17: 7611 (TID-14495)
containment of, after release from reactor fuels, 17: 6311 (HW-SA-2843)
determination in fuels irradiation, 17: 7584
distributions of, from uranium-235 thermal fission, 17: 7098 (NP-12330 (p.79-85))
energy distributions of, from photofission of uranium-238, 17: 7291
fusion reactions of, in fission explosions to form elements in the platinum group, 17: 7242
gamma shielding, attenuation coefficients, 17: 7502
handling of, design of shipping casks for, 17: 6362
kinetic energy of, emitted in subbarrier fission, 17: 7300
metabolism of mixed in man, 17: 5699 (BNL-6503)
movement in uranium dioxide during irradiation tests, 17: 6742 (HW-SA-2309)
neutron resonance cross sections, 17: 7595(R) (ACNP-62018)
release of, from metallic uranium, mechanism of, 17: 6174
separation of tellurium and iodine from, 17: 6172
yields from uranium-235, 17: 7085 (NP-12309)

FISSION RECOILS
use in organic compound synthesis, 17: 6176(P)

FISSIONABLE MATERIAL
criticality of, technique for computing, 17: 6942 (TID-15342)

FLUID FLOW
heat and mass transfer in fixed and fluidized beds, 17: 6232
heat transfer to, in concentric annuli, 17: 6228 (BNL-6177)
hypersonic, shock waves in, 17: 6783 (BSD-TDR-62-337)
magnetohydrodynamic, equations for, 17: 6796 (NP-12332)
two phase, one component critical, theory of, 17: 6227 (ANL-6633)
two-phase patterns of, with heat addition, 17: 7613(R) (UNC-5042)

FLUID FLOW (TURBULENT)
of electroconductive liquid, in presence of magnetic field, 17: 7442
past wedges, analysis of magnetohydrodynamic supersonic, 17: 6898
wall effects on, development of law for, 17: 6239

FLUID FUEL REACTORS
design of circulating-fuel reflector-moderated, 17: 7568 (PWAC-189 (Vol.I))
design of circulating-fuel reflector-moderated, 17: 7569 (PWAC-189 (Vol.2))
design study of core-moderated circulating-fuel, 17: 7567 (PWAC-186)
development of, for propulsion systems, 17: 7538(R) (DCAS-TDR-62-44)

FLUIDIZATION
heat and mass transfer in beds, 17: 6232

FLUIDS
kinetics of compressible, PiC numerical analysis of, 17: 6230 (TID-14550)
magnetohydrodynamic shock waves in, strong cylindrical, 17: 6844
magnetohydrodynamic Alfvén-wave stability in incompressible, 17: 6845
transport properties of, statistical theory for, 17: 6818

FLUORESCENCE
activator and coactivator effects on, in phosphor crystals, 17: 6092

FLUORIDE VOLATILITY PROCESSES
corrosive effects on construction materials in, 17: 6511(R) (BMI-1593 (Del.))

FLUORIDES
analysis for metals by titration with EDTA, use of vanadyl ion as back-titrant in, 17: 5995
corrosive effects of fused, on reactor materials, 17: 7606(R) (ORNL-1515)
permissible levels for occupational exposure, 17: 5725

FLUORINE
determination of, in atmosphere, 17: 5959 (PG-Report-329)
effects on hematopoietic system in rats, 17: 5822
nitrogen nucleus reactions at 27.5 Mev, 17: 7252

FLUORINE ISOTOPES F-17
energy levels, 17: 7228
proton Coulomb energies in, 17: 7090 (NP-12330(p.17-21))

FLUORINE ISOTOPES F-19
alpha reactions (α,t) at 18.5 Mev, 17: 7224
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
energy level at 2.78 Mev, 17: 7239
helium nucleus reactions (helium-3,d) at 13.0 Mev, 17: 7224
proton reactions (p,$\alpha\gamma$), resonance energies and half width for, 17: 7173

FLUORINE ISOTOPES F-20
equipment for research on, 17: 6170

FLUORINE SYSTEMS
F–U, thermodynamics between UF_4 and UF_6, 17: 6106

FLUOROFORM
hydrogen bonding to tetrahydrofuran, deuterium isotope effect, 17: 6120

FOOD
analysis for radioactivity, spectrometric, 17: 5733
contamination by chemical, biological, and radiological warfare agents, 17: 6339
contamination by fall-out, protection from harmful effects of, 17: 6338
protection of stored grain against weevils, effectiveness of irradiation, 17: 6368
radiation effects on processed, from fallout or nuclear explosion, 17: 6340
radiation processing of pork, effects of moisture on thiamine retention, 17: 6365
radiation processing, review, 17: 5662
radiosterilization of pork sausages, storage life after, 17: 6367
separation of volatile components from coffee beans and irradiated beef, chromatographic, 17: 6000
strontium-90 levels in, 17: 5751(R) (HASL-132)

FORMALDEHYDE
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)

FORMALDEHYDE POLYMERS
diffusion of ionol and phenothiazine in, 17: 5943

FORMATES
radiation effects on reactions with hydroxyl radicals in ferri- and ferrocyanide solutions, 17: 6165

FORMIC ACID
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)

FRANCE (HERAULT)
radioactivity of rocks and thermal waters in region of Lamalou and Bedarieux, 17: 6281

FRANCE (PUY-de-DÔME)
radioactivity and uranium distribution in lava of Puys Chain, 17: 6279
FREE RADICALS
competing reactions, tracer studies, 17: 6071
electron spin resonance of, in irradiated alanine, 17: 5692
electron spin resonance spectra of, in gamma irradiated acetyl-L-glutamic acid, 17: 6152
radioinduced in pentane, 17: 6144
FREONS
positronium decay rates in, ortho-, 17: 6882
FREQUENCY MODULATION
in cyclotrons with ferroelectric crystals, 17: 7413
FROGS
analysis for chloride in fluids and tissues in, by isotope dilution, 17: 5999
radiation effects on competence of ectoderm of gastrula, 17: 5807
FUEL CELLS
development and feasibility of biochemical, 17: 5663
FUELS
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
FUMARATES
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
FUMARIC ACID
radiation effects in urea inclusion compound of, 17: 6162
FURANS
hydrogen bonding of fluoroform to tetrahydro-, deuterium isotope effect, 17: 6120
methyl tetrahydro-, radiolysis of glassed, 17: 6148
FURNACES
electron beam, with multiple field guidance of electrons, 17: 6226(P)

G

GADOLINIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
determination in thorium by spectral analysis, 17: 6021
neutron capture in, internal conversion spectra from, 17: 7182
separation from europium by ion exchange, 17: 7125 (NP-12330(p.253-7))
separation from rare earths, 17: 6019
GADOLINIUM ACETATES
preparation of anhydrous, by desolvation, 17: 6082
GADOLINIUM CARBIDES
vaporization, 17: 6109
GADOLINIUM CHELATES
with 2-hydroxybenzophenone, emission spectra, 17: 6085
GADOLINIUM ISOTOPES
alpha decay systematics for, 17: 7199
GADOLINIUM ISOTOPES Gd-148
alpha decay scheme of, 17: 7150
GADOLINIUM ISOTOPES Gd-150
alpha decay scheme of, 17: 7150
GADOLINIUM ISOTOPES Gd-152
decay of, E2 and K conversion coefficients in, 17: 7203
internal conversion coefficients of 2^+–0^+ E2 transitions of, 17: 7079 (IS-272)
GADOLINIUM ISOTOPES Gd-154
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
GADOLINIUM ISOTOPES Gd-155
neutron reaction (n,γ), gamma and internal conversion spectra from, 17: 7175
GADOLINIUM ISOTOPES Gd-156
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
GADOLINIUM ISOTOPES Gd-157
neutron reaction (n,γ), gamma and internal conversion spectra from, 17: 7175
GADOLINIUM ISOTOPES Gd-158
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
GADOLINIUM ISOTOPES Gd-160
energy levels with spin and parity 4^+ and 6^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
GADOLINIUM OXYTELLURIDES
preparation and properties, and crystalline structure, 17: 6068
GALLIUM ALLOYS
Ga–Ge–Zr, phase studies, 17: 6729
Ga–Nb–Zr, phase studies, 17: 6729
GALLIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
GALLIUM PERCHLORATES
reactions with chromium(III)–neptunium(IV) complex in perchloric acid, spectra of, 17: 6074
GAMMA ABSORPTION CROSS SECTIONS
measurement for heavy Mössbauer atoms in light host lattices, 17: 6879
GAMMA RADIATION
absorption by impurity nuclei in crystals, resonance, 17: 6854
aerial monitoring of, in Galveston, Tex., area, 17: 6254 (CEX-62.6.1)
attenuation factors for shielding materials, 17: 7501
biological effects, effects of dose on recovery rate, 17: 5909 (TID-14019)
biological effects in mice, effects of previous exposure, 17: 5776 (TID-14698)
biological effects in mice, effects of ancestral x-ray exposure, 17: 5777 (TID-15181)
biological effects of low doses on plant yields, 17: 5827
biological effects in mice, 17: 5671(R) (LAMS-2780(p.85-129))
conductivity in cadmium sulfide crystals, kinetics of, 17: 6886(T)
detection and measurement of, design of monitor for, 17: 6433 (HW-71354)
detection and measurement of, description of instruments for, 17: 6447
detection and measurement of, design of double collimator for, 17: 5732
detection and measurement of, mixed with neutrons using a dual ionization chamber system, 17: 6479
dose rates at water surface in Merlin, 17: 7633 (JUL-73-RE)
dosimetry, in the presence of neutrons, 17: 5774 (TID-13984)
dosimetry of pulsed and steady-state, 17: 5780 (USNRDL-TR-583)
effect on *Mus musculus*, lethal, 17: 5863
effects on development of planaria, 17: 5789
effects on ear in man, 17: 5834
effects on erythropoiesis in rats, effect of thyroxine, 17: 5883
effects on erythrocyte metabolism, whole-body exposure in rats, 17: 5843
effects on growth rate of *Escherichia coli*, effect of oxygen, 17: 5878
effects on hematopoietic organs and hypophysis in mice, 17: 5872
effects on incorporation of phosphorus-32 into nucleic acids of tumor cells, effects of temperature, 17: 5832
effects on jaws and teeth in rats, 17: 5867
effects on man of 400 to 450 rad whole-body exposure delivered over 8 hours, 17: 5874
effects on nucleotide metabolism in liver, whole-body exposure, 17: 5879
effects on oxidation in fats, 17: 5821
effects on phagocytic index of leukocytes in dogs, 17: 5884
from soils, neutron-induced, 17: 6258 (NDL-TR-41)
genetic effects on tomatoes, 17: 5892
interactions with nucleons, meson (π^0) production from, 17: 7007
pair production cross sections for, 17: 7116 (NP-12330(p.186-92))
polarization of, detection of circular, 17: 7107 (NP-12330(p.137-40))
polymerization of ribomononucleotides by, 17: 5791
propagation near air-ground interface, 17: 6955 (RM-3399-PR)
reactions (γ,d), (γ,p), and (γ,pn) with lead-208, 17: 7289
reactions (γ,dn) and (γ,dp) with oxygen-16, 17: 7295
reactions (γ,n) with indium-115, photoneutrons from, 17: 7280
reactions (γ,n) and (γ,p) on nuclei, spin-orbit effects in, 17: 7167
reactions (γ,p) with lead-207, 17: 7289
reactions (γ,π^-) with nuclei, 17: 6975
reactions on nuclei, electron pair production in, 17: 7304
reactions on nuclei, giant dipole resonances in, 17: 7305
reactions with carbon at 150 Mev, proton spectrum from, 17: 7202
reactions with deuterium and hydrogen, mesons (π^0) production in, 17: 7036
reactions with gold at 662 kev, Auger and Compton effects in, 17: 6792(R) (ISS 62/14)

scattering of, small-angle coherent, 17: 7111 (NP-12330(p.158-61))
scattering of variable-energy, by nuclei for excitation and measurement of energy levels, 17: 7229
shielding of, attenuation coefficient, 17: 7502
spectra in accelerator shielding materials, 17: 7401
GAMMA SHIELDING
effectiveness of structures, model studies, 17: 7497 (DRCL-364)
GAMMA SOURCES
calibration and standardization of point and distributed, 17: 6822
design and operation of kilocurie cesium-137 therapy unit, 17: 5764 (AERE-R-3334)
dosage distributions for telecobalt, effects of horizontal motion of irradiation table on, 17: 6357
GAMMA SPECTRA
computer analysis of, 17: 6442 (USNRDL-TR-592)
GAMMA SPECTROMETERS
analyses of pulse-height distributions in, using computers, 17: 6442 (USNRDL-TR-592)
design and operation of 100-channel, with magnetic memory, 17: 6280
fabrication for lunar surface exploration, 17: 5672(R) (LAMS-2780 (p.130-80))
operation for whole-body counting, 17: 5672(R) (LAMS-2780(p.130-80))
sterilization of, for lunar probe, 17: 5674(R) (LAMS-2780(p.211-45))
GAMMA SPECTROSCOPY
sodium-24 determination in blood by, 17: 5968 (PG-Report-385)
use in determination of source of nuclear system pipe wall radiation, 17: 6574 (TID-15281)
use of, in analysis of fuels, 17: 6473
GAS COOLED REACTORS
design of ceramic-fueled and ceramic-moderated, 17: 7607 (ORNL-2752)
development, 17: 7546(R) (HW-74761)
development status of high temperature, review, 17: 7598 (GA-2566)
loading and unloading of, 17: 7585(P)
GAS FLOW
measurement using krypton-85, 17: 6366
GASES
diffusion in positive column in magnetic field, 17: 7475
dynamics of rarefied, dispersion relations in, 17: 6238
electron distribution in ionized, possibility of non-Maxwellian, 17: 6830
electron removal from, by refractory dust particles, 17: 7467
energy, mass, and momentum conversion relations of partially ionized, equations for, 17: 6786 (DCAS-TDR-62-133)
kinetics of rarefied, status of research programs on, 17: 7434 (UTIA-REV-18)
model of interplanetary, 17: 6909
pressure measurement in pressure vessels, apparatus for, 17: 6429(P)
production by radiolysis of sugar solutions, 17: 6142
removal of non-condensable, from fibers, 17: 6225(P)
GASTROINTESTINAL TRACT
pathology and regeneration of lesions induced by radiation sickness, 17: 5929
radiation injury, protective effects of aminoethylisothiuronium, 17: 5891
GENETICS
kinetics of two-break chromosome exchanges, 17: 5690
GEOCHEMICAL PROSPECTING
for uranium deposits, 17: 6252 (CEA-2154)
GEOCHEMISTRY
gamma spectroscopy in, 17: 6280
GEOLOGY
book: *Scandium: Its Geochemistry and Mineralogy*, 17: 6301
model of continent formation, 17: 6291
of Los Angeles area, surface, 17: 6253 (CEX-59.4.16)
GEOMAGNETIC FIELDS
boundary with inner Van Allen zone, 17: 6934(T)
boundary with interplanetary medium, nature of, 17: 6923
compression during sudden commencement, 17: 6922
effects of high-altitude explosions on, 17: 6841
effects on radiation belts, 17: 6937(T)
electron diffusion in, Van Allen, 17: 6941
electron trapping at high altitudes in, 17: 6924
electron trapping at low altitudes in, 17: 6925
hydromagnetic waves in, low-frequency, 17: 6926
interaction with solar particles, 17: 6913
perturbation of, by high-altitude nuclear explosions, 17: 6283
pulsations at the auroral zone, 17: 6838
structure of, line of minimum intensity of cosmic radiation, 17: 6938(T)
GEOMAGNETIC STORMS
effects of solar flares on, 17: 6920
effects of trapped protons on, 17: 6921
particle flux in space during, 17: 6922
sudden commencement of, radiation intensity increase coincident with, 17: 6928
GEOPHYSICS
model of continent formation, 17: 6291
thermal properties of earth, models and theories for, 17: 6294
GERMANIUM
effects on corrosion of antimony–zirconium alloys by water at 680°F, 17: 6561(R) (ARF-2198-34)
radiation effects on, neutron, 17: 6757
GERMANIUM ALLOYS
Ga–Ge–Zr, phase studies, 17: 6729
GERMANIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
GERMANIUM CRYSTALS
radiation effects, 17: 6738 (ASD-TDR-62-233)
GERMANIUM HYDRIDES
mass spectra of volatile, 17: 6791 (IS-424)
GERMANIUM ISOTOPES Ge-71
decay of isomers of, 17: 7294
GERMANIUM JUNCTIONS
performance as x-ray spectrometer, 17: 6458
GERMANIUM SYSTEMS
Bi–Ge–Te, properties as thermocouple, 17: 7642(R) (AD-276092)
GIBBSITES
absorptive properties of, for cesium and strontium, 17: 7653(R) (ORNL-TM-396)
GLASS
damage to, from plasma produced by exploding wires, 17: 7495
radiation effects on thermoelectric effect in cabal-type, gamma and, 17: 6766
radioactivity, 17: 6415
radiolysis of organic, electron attachment and solvation at −196°C in, 17: 6148
GLASS TEXTILES
development of fuel-impregnated fiberglas, 17: 6530 (TID-16847)
GLUCOSE
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
radiolysis of solutions of, gas production in, 17: 6142
transport in small intestines of rats, radiation effects on, 17: 5933
GLUTAMIC ACID
analysis for carbon-14 by continuous scintillation counting, 17: 5709
GLUTAMIC ACID, *N*-ACETYL-
radiation effects on, electron spin resonance spectra of free radicals produced by, 17: 6152
GLUTARIC ACID, α-OXO-
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
GLYCEROL
protective effects against radiation injury in *Staphylococcus aureus*, 17: 5771 (TID-13275)
GLYCINE
analysis for carbon-14 by continuous scintillation counting, 17: 5709
electron magnetic resonance of, effects of gamma and x radiation on, 17: 6154
radiation effects on reactions with hydroxyl radical in ferri- and ferrocyanide solutions, 17: 6165
GLYCOLYSIS
radiation effects on, in tumor cells, comparison to effects of cell toxin, 17: 5900
GLYOXYLIC ACID
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
GOLD

dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
gamma reactions at 662 kev, Auger and Compton effects in, 17: 6792(R) (ISS 62/14)
ion ranges in, determination from collection experiments, 17: 6820
radiation damage in, spot density and diameter of neutron, 17: 6763
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
rare gas ions reactions at 100 to 30,000 ev, yields of secondary ions from, 17: 7268

GOLD ALLOYS
Bi–Au, coprecipitation of radioactive tracers in, 17: 6683 (UCRL-6452 (Pt.II))

GOLD FILMS
adsorptive properties for stearic acid from hexadecane solution, 17: 6078

GOLD ISOTOPES
precipitation in bismuth alloys, 17: 6683 (UCRL-6452(Pt.II))

GOLD ISOTOPES Au-197
gamma resonance absorption by, anomalies in, 17: 6879
half life of the first excited state of, from Mössbauer studies, 17: 7234
nuclear magnetic moment of the first excited state of, from Mössbauer measurements, 17: 7234
scattering of helium-3 particles by, 17: 6957 (TID-17357(Pt.I))

GOLD ISOTOPES Au-198
gamma specific emission coefficient, 17: 6431 (CEA-2036)
tracer applications in industry, 17: 6372
uptake by skin, effects of inflammation, 17: 5679

GONADAL HORMONES
effects on radiosensitivity of gonads in immature female rats, 17: 5838

GONADS
radiation dose to, from dental x rays, 17: 6349
radiation dose to, from diagnostic radiography of hip joint in children, 17: 6351
radiation effects on female, whole-body exposure, 17: 5795
radiation effects in male rats, effects of testosterone treatment, 17: 5796
radiation effects on prolan stimulation of ovaries, 17: 5817
radiation effects on developing mouse oocytes, 17: 5835
radiation effects on lipid content and hormone activity of testes, 17: 5842
radiation exposure of, from chest x rays of infants, 17: 6352
radiosensitivity in immature female rats, effects of hormones, 17: 5838

GONIOMETERS
development for x-ray diffraction analysis of crystals for use in neutron monochromatization, 17: 6058(T) (AEC-tr-5566)
performance of Schultz-type, analysis of errors in, 17: 6380 (AAEC/TM-158)

GRANITE DEPOSITS (N.H.)
thorium abundance in Conway, 17: 6297

GRANITES
analysis for thorium, 17: 6297

GRAPHITE
bibliography on, 17: 6521 (NP-12417)
catalytic oxidation, 17: 6679 (TID-15270)
chemical reactivity effects of, on air-cooled channel instability, 17: 7534 (BNL-5891)
development as solid lubricant, 17: 7606(R) (ORNL-1515)
dimensional stability of, effects of liquid sodium on, 17: 7563(R) (PRDC-TR-59)
electric conductivity, 17: 6520(R) (NP-12373)
electric conductivity, 17: 6531(R) (TID-17504)
etching using oxygen at 700 to 870°C, 17: 6722
mechanical properties, 17: 6670(R) (NP-12350)
neutron rethermalization in, 17: 7055 (HW-SA-2415)
oxidation characteristics, 17: 7554(R) (HW-74761(p.10.1-6))
oxidation of, at high temperatures, 17: 6689 (WAL-TR-851.4/2)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
oxidation of, microscopic studies of, 17: 6531(R) (TID-17504)
properties of pyrolytic, 17: 6550
radiation effects on dimensional stability at 475 to 850°C, 17: 7554(R) (HW-74761(p.10.1-6))
radiation effects, 17: 7563(R) (PRDC-TR-59)
rare gas ions reactions at 100 to 30,000 ev, yields of secondary ions from, 17: 7268
reactions with uranium dioxide, 17: 6106
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
sampling from reactors, apparatus for, 17: 7593(P)
structural properties, 17: 6717
thermal conductivity, 17: 6520(R) (NP-12373)
thermal conductivity of, at 1200 to 2200°K, 17: 6640 (ASD-TDR-62-608 (Pt.I))
thermal expansion of, effect of porosity in, 17: 6715
thermal properties, 17: 6670(R) (NP-12350)

GRAPHITE CRYSTALS
dislocation loops and vacancies in, 17: 6702

GRAPHITE MODERATED REACTORS
design of sodium-cooled power, 17: 7622

GRAPHITE SYSTEMS
graphite-Fe, magnetic susceptibility of, 17: 6531(R) (TID-17504)
graphite-UC_2, radiation effects on, 17: 6748 (ORNL-3340)
graphite-Fe, thermoelectric power in, 17: 6531(R) (TID-17504)

GRASS
radioactivity of USSR, 1958, 17: 6288

GRAVITATION
cosmological changes in, terrestrial effects of, 17: 6300
intensity variations in earth's, design of gravimeter for measuring annual, 17: 6402 (PUC-1962-56)
interactions with fermions, 17: 7049

GREAT BRITAIN
fallout monitoring in, 1960, 17: 6363

GRINDING
design of hold-down fixture for flat René 41 part, 17: 6626
of heat-resisting alloys, 17: 6624

GROUND WATERS
movement of subterranean, tracer study of, 17: 6377

GUINEA PIGS
radiation effects on skin of, protective effects of cortisone against, 17: 5915
radiation effects on electroencephalographic changes in brain, 17: 5902
radiation effects on anaphylactic sensitivity, 17: 5783
radiation effects on experimental allergic encephalomyelitis in, 17: 5801

H

HAFNIUM
analysis, 17: 6020
determination in presence of zirconium, titrimetric, 17: 6002
determination in tantalum, photometric, 17: 6022
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
electric conductivity of, temperature effects on, 17: 6814(T) (UCRL-Trans-887(L))
separation from zirconium by solvent extraction, 17: 6020

HAFNIUM ALLOYS
Al–Hf, phase studies, 17: 6729
Hf–Nb, phase strengthening, 17: 6555
Hf–Nb, phase studies, 17: 6668(R) (NMI-9246)
Hf–W, properties of wrought, 17: 6672 (NP-12383)

HAFNIUM BORIDES
compact and powder preparation, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)

HAFNIUM CARBIDES
compact preparation, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
reflection spectra, 17: 6520(R) (NP-12373)
thermal expansion, 17: 6520(R) (NP-12373)

HAFNIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007

HAFNIUM FLUORIDES
effects on freezing point of sodium fluoride, 17: 6088

HAFNIUM ISOTOPES Hf-170
gamma spectrum and half life, 17: 7162

HAFNIUM ISOTOPES Hf-171
gamma spectrum and half life, 17: 7162
HAFNIUM ISOTOPES Hf-174
neutron cross sections of, temperature effects on, 17: 7084 (LA-2763)
HAFNIUM ISOTOPES Hf-176
neutron cross sections of, temperature effects on, 17: 7084 (LA-2763)
HAFNIUM ISOTOPES Hf-177
energy levels of deformed, lifetimes of, 17: 7292
neutron cross sections of, temperature effects on, 17: 7084 (LA-2763)
HAFNIUM ISOTOPES Hf-178
neutron cross sections of, temperature effects on, 17: 7084 (LA-2763)
HAFNIUM ISOTOPES Hf-179
neutron cross sections of, temperature effects on, 17: 7084 (LA-2763)
production of, activation cross section for, 17: 6132(R) (TID-17272)
HAFNIUM ISOTOPES Hf-180
neutron cross sections of, temperature effects on, 17: 7084 (LA-2763)
HAFNIUM OXIDES
HfO_2–W, tensile strength, 17: 6688 (WADD-TR-60-37(Pt.III))
HAFNIUM SYSTEMS
Hf–O, thermodynamic properties of, 17: 6111
HALDEN BOILING REACTOR
void variations in, design of impedance meter for determining, 17: 5656(R) (KR-29)
HALL EFFECT
use in determining electron density in plasma, 17: 7437
HALLAM POWER REACTOR
description and design of, 17: 7622
HANDBOOKS AND MANUALS
on radioisotope properties and toxicology, 17: 5748
HANFORD PRODUCTION REACTORS (N)
decontamination wastes from, processing of, 17: 7651 (HW-74507)
HANFORD WORKS, RICHLAND, WASH.
accumulation of radionuclides by aquatic insects of Columbia River, 17: 5702 (HW-SA-2848)
HARDTACK OPERATION
radiological safety support, 17: 6317 (OTO-58-3)
HARWELL SYNCHROTRON
design and operation of, 17: 7312 (BNL-6511(p.38-49))
HASTELLOY X
fatigue properties of, correlation with Inconel X, 17: 7565(R) (PWAC-161)
machining, 17: 6611
radiation effects on, 17: 6511(R) (BMI-1593(Del.))
HEAD
radiation effects on bones in, after therapy of parotid gland, 17: 5849
radiotherapy of, effects on ear, 17: 5896
HEALTH PHYSICS
assessment of radiation hazards, 17: 6330
tritium hazards control at Savannah River Plant, 17: 6309 (DPSPU-62-30-5)
HEART
iodine-131 distribution in precordium, injected, 17: 5685
radiation effects on morphology, whole-body exposure, 17: 5912
radiation effects on activity, 17: 5782(T) (JPRS-15872)
strontium effects on contraction, 17: 5686
HEART DISEASES
diagnosis of myocardial infarction using iodine-131, 17: 5685
HEAT EXCHANGERS
development for liquid metal cooled reactors, 17: 7606(R) (ORNL-1515)
transfer functions of, theoretical, 17: 6231
HEAT EXCHANGERS (GAS-LIQUID)
development studies of fin materials for high-temperature, 17: 6673 (ORNL-2065)
HEAT EXCHANGERS (LIQUID-LIQUID)
development, 17: 7565(R) (PWAC-161)
HEAT-RESISTING ALLOYS
book: *Machining Difficult Alloys*, 17: 6608
broaching, 17: 6622
broaching, tool design for, 17: 6621
grinding, 17: 6624
grinding, effects of variables, 17: 6625
machining, tools for single-point cutting in, 17: 6619
milling, 17: 6612
HEAT TRANSFER
between fuel element and its canning material, correlation of experiment and theory, 17: 6237
boiling burnout in 19-rod bundle fuel element, effects of rod spacing on, 17: 7552(R) (HW-74761(p.8.1-15))
burnout in saturated pool boiling, effects of parameters, 17: 6241
coefficients in reactors, estimation of, 17: 6236
dissipation in micromodule packages, 17: 6229 (SCTM-233-62(14))
fluids, research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
in fixed and fluidized beds, 17: 6232
in packed beds, equations for transient, 17: 6234
to fluids flowing in concentric annuli, analysis of, 17: 6228 (BNL-6177)
HEAT TRANSFER SYSTEMS
radiation contamination control in, for nuclear power plants, 17: 7587(P)
HEATERS
design of ceramic spraymat for accelerating outgassing of vacuum chambers, 17: 6205 (CERN-62-28)
HEAVY WATER REACTORS
development, 17: 7602(R) (HW-75725)
water-d_2, removal from, 17: 7588(P)
HELIUM
critical velocities and energy of a vortex ring in a tube of liquid, 17: 6852
determination in molybdenum, niobium, and tungsten by vacuum extraction, 17: 6022
electric discharge in, electron density in, 17: 7437
electron elastic scattering by, variational calculations for, 17: 7507
formation of bubbles of, in alpha-irradiated aluminum, 17: 6761
photodisintegration of, cross section for, 17: 7238
plasma, volume recombination in a magnetic field, 17: 7480
positronium decay rates in, ortho-, 17: 6882
proton reactions on, excitation and polarization from, 17: 7263
scattering from cleavage plane of lithium fluoride, molecular, 17: 6835
scattering from lithium fluoride cleavage plane, 17: 6794 (K-1498)
sound absorption in liquid, theory of second, 17: 6871
total ionization cross sections, 17: 6805 (UCRL-6702)
transition (I-II) delay time at 2.15 and 2.09°K, 17: 6895
HELIUM ION BEAMS (He-3)
reactions (helium-3,d) with fluorine-19 at 13.0 Mev, 17: 7224
scattering by aluminum, beryllium, bismuth, copper, and tin at 31 Mev, 17: 7148 (UCRL-9996)
HELIUM IONS
electron ejection from tungsten by, energy distribution of, 17: 6853
electron ejection from a clean surface of molybdenum by, 17: 6855
reactions with copper, gold, and graphite at 10C to 30,000 ev, yields of secondary ions from, 17: 7268
reactions with niobium nuclei at 240 to 880 Mev, 17: 7149 (UCRL-10461)
HELIUM ISOTOPES He-3
abundance in the sun, 17: 6911
molar volume and thermal expansion of, at 0.16 to 1.8°K, 17: 6819
nuclear magnetic resonance in solid, 17: 6868
scattering of, by aluminum-27, carbon-12, gold-197, and platinum, 17: 6957 (TID-17357(Pt.I))
triton reactions (t,p) and (t,α), 17: 7250
HELIUM ISOTOPES He-4
abundance in the sun, 17: 6911
bond lengths in solid, 17: 6046 (TID-13145)
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
ground state of liquid, 17: 6883
meson (π^-) capture by, 17: 6979
second-sound attenuation in flowing helium II, 17: 6881
HELIUM ISOTOPES He-5
binding energy for breakup into an alpha particle and neutron, 17: 7250
HELIUM ISOTOPES He-6
decay, 17: 7154
half life, 17: 7198
HELIUM SYSTEMS
D_2–He, kinetic properties of liquid and solid, 17: 6103
DH–He, kinetic properties of liquid and solid, 17: 6103
He–H_2, kinetic properties of liquid and solid, 17: 6103

HEMATOPOIETIC SYSTEM
fluorine and strontium-90 effects on, in rats, 17: 5822
function studies using iron-59, 17: 5673(R) (LAMS-2780(p.181-210))
radiation effects on, in mice, 17: 5872
radiation effects on erythropoiesis, tracer study on effects of thyroxine, 17: 5883
radiation injuries, screening test on effects of various compounds on recovery, 17: 5910 (TID-17379)
radiation injuries to, therapy using *Aralia*, leukogen, and *Restharrow* on, 17: 5927
reaction of lethally irradiated mice to injected tissues, 17: 5802
HEMOGLOBIN
crystal structure of, electron spin resonance spectra of, 17: 5692
radiation effects on oxidation stability, whole-body exposure, 17: 5843
radioinduced changes in, correlation with leukopenia in acute radiation sickness in rabbits, 17: 5853
HEMORRHAGE
radioinduced, megavoltage, 17: 5805
HENDECANE
determination in kerosene by vapor-phase chromatography, 17: 6195
HEXANE
C_6H_{14}–C_6H_6, diffusion of toluene in, 17: 6060
C_6H_{12}–C_6H_{14}, diffusion of toluene in, 17: 6060
HIGH-ALTITUDE EXPLOSIONS
effects of nuclear, 17: 6296
effects of thermonuclear, on spread F development in the ionosphere, 17: 6848
effects on geomagnetic fields, 17: 6841
electron injection into radiation belts, 17: 6839
geomagnetic effects of nuclear, 17: 6283
ionospheric effects of nuclear, 17: 6278
HIPPURIC ACID
iodine-125 labeled, properties for renograms, 17: 5728
HIROSHIMA
radiation effects on tumor incidence in populations, 17: 6333
statistical analysis of population for late radiation effects, 17: 6332
survey on incidence of mongolism in offspring of pregnant women exposed to radiation from atomic explosion, 17: 5848
HOBO PROJECT
in situ measurements of elastic properties of volcanic tuff, 17: 6275 (UCRL-6477)
HOLMIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
separation from rare earths, 17: 6019
HOLMIUM ALLOYS
Co–Ho, magnetic structure of, 17: 6706
HORMONES
radiation effects on activity of male estrogenic, 17: 5842
HYDRACRYLIC ACID, β-LACTONE
radioinduced polymerization, 17: 6155
HYDRAULIC FLUIDS
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
HYDRAZINE
formation of, by radiolysis of ammonia, 17: 6125 (BNL-6016)
preparation of, development of in-reactor fissio-chemical process for, 17: 6123(R) (AGN-AN-756)
HYDROCARBONS
meson (π^-) capture by hydrogen in, 17: 7083 (JINR-P-1081)
radiolysis of glassed, electron attachment and solvation at −196°C in, 17: 6148
HYDROCHLORIC ACID
reactions with nitrosylruthenium, formation of chloro complexes by, 17: 6051 (TID-15360)
HYDROFLUORIC ACID
polarography of, using teflon dropping mercury electrode, 17: 5987
HYDROGEN
absorption by palladium, effects on alpha–beta transitions and electric conductivity, 17: 6690 (WAPD-T-1268)
absorption of, by titanium, 17: 6699(T) (SCL-T-451)
analysis of atmospheric, for tritium, 17: 5947(R) (AFCRL-62-295)
combustion of oxy-, catalytic effects of palladium and platinum charcoal on, 17: 6098
conversion of para-, catalytic effects of palladium and platinum charcoal on, 17: 6098
determination by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
determination in organic compounds by thermal neutron scattering, 17: 5949 (BNL-5814)
electron capture by molecular, dissociative attachment in, 17: 6862
electron detachment by magnetic fields, 17: 6880
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
energy level excitation in atomic, by fast protons, 17: 6861
exchange with deuterium, radiation effects on catalytic properties of magnesium oxide for, 17: 6086
ionization zone of giant stars, energy transport in, 17: 6904
line splitting, measurement of Zeeman, 17: 6910
meson (π^-) capture by, in chemical compounds, 17: 7083 (JINR-P-1081)
mesons (K^+) inelastic charge exchange in, cross sections for 1.12 and 1.45 Bev, 17: 6966
mesons (π^0) photoproduction in, 17: 7036
nuclear spin isomers of, separation of, by gas chromatography, 17: 6493
production by radiolysis of sugar solutions, 17: 6142
properties of liquid and solid, measurement of kinetic, 17: 6103
radiation effects on ionization of liquid, 17: 6747(R) (NP-12364)
reactions of atoms with ethylene and propene, 17: 6071
reactions of atoms with olefins, 17: 6145
removal from boilers, 17: 6225(P)
thermal conductivity of plasma of, 17: 7439
HD–H_2, isotope shift in nuclear magnetic resonance spectra of, 17: 6066
HYDROGEN IONS
atomic absorption coefficient of negative, 17: 6825
detection of energetic, by collision-induced molybdenum trioxide color changes, 17: 6409 (UCRL-6793)
dissociation of negative, in accelerators, 17: 7360
exchange with hydrogen in 1,3,5-trimethoxybenzene, deuterium isotope effect, 17: 6121
HYDROGEN ISOTOPES
exchange between hydrogen and water, catalytic effects of palladium and platinum charcoal on, 17: 6098
separation of, by gas chromatography, 17: 6493
HYDROGEN SYSTEMS
D_2–H_2, kinetic properties of liquid and solid, 17: 6103
DH–H_2, kinetic properties of liquid and solid, 17: 6103
He–H_2, kinetic properties of liquid and solid, 17: 6103
H–Zr, phase diagrams, 17: 6649 (DC-61-7-26)
HYDROMAGNETIC WAVES
attenuation in ionosphere, 17: 6913
measurements in distant geomagnetic field, 17: 6926
propagation through ionized gas in magnetic field, 17: 7472
properties of strong cylindrical, 17: 6844
shock boundary layers and sheath potentials in, in air, 17: 6899
stability of plane Alfvén, in incompressible, 17: 6845
structure in dense media, 17: 6901
HYDROXYL RADICAL
radiation effects on reactions with ferri- and ferrocyanides in organic solutions, 17: 6165
HYPERONS
interactions and properties of, model for, 17: 7016
interactions with mesons, Yukawa-type, 17: 7008
production by primary cosmic radiation as explanation of high-energy cosmic muons and photons, 17: 6940
HYPERONS (Λ^0)
photoproduction near the threshold, 17: 7051

I

ICE-*d*,
neutron polarization by, fast, 17: 7064
IGNEOUS ROCKS
strontium isotope ratios in basalt, 17: 6291
ILLITES
kinetics of potassium exchange in, 17: 6102
IMAGE BRIGHTNESS INTENSIFIERS

use in photographing electron avalanches, 17: 7018
IMMUNITY
radiation damage to, effects on bone marrow and tissue transplants in animals, 17: 5814
radiation effects on natural, 17: 5884
radiation effects on active and passive, to bone marrow transplantations in mice, 17: 5916
reactions against transplanted bone marrow or whole organs in irradiated mice and men, 17: 5683
reactions of lethally irradiated mice to injected hematopoietic tissue, 17: 5802
IN-PILE LOOPS
corrosion of, by coolant, determination by gamma spectroscopy of radioactive deposits from, 17: 6574 (TID-15281)
INCONEL X
brazing and welding, 17: 7606(R) (ORNL-1515)
brazing to copper, 17: 7606(R) (ORNL-1515)
corrosion by fused fluorides, 17: 7606(R) (ORNL-1515)
corrosion by nitric acid, 17: 6192(T,R) (EURAEC-382)
corrosion by steam at 1275 to 1400°F, 17: 7601(R) (GNEC-254)
drilling of 750, 17: 6615
fatigue properties of, correlation with Hastelloy X, 17: 7565(R) (PWAC-161)
machining characteristics of 750, 17: 6609
mechanical properties at 1200 to 1800°F, 17: 7606(R) (ORNL-1515)
milling of 750, 17: 6612
radiation effects on mechanical properties at 1500°F and 3000 and 4000 psi, 17: 7606(R) (ORNL-1515)
INDIUM
neutron reactions (n,α) with, direct interaction processes in, 17: 7094 (NP-12330(p.46-52))
neutron reactions (n,α) at 14 Mev, alpha spectra from, 17: 7207
separation by solvent extraction using alkyl phosphoric acid, 17: 6200
separation from chloride solutions by ion exchange, comparison of liquid and resin anion exchange systems for, 17: 6181 (IA-780)
separation of, radiochemical and vacuum distillation, 17: 6135
INDIUM ALLOYS
Sb–In, pinch effect in electron-hole plasma in, 17: 7479
INDIUM CHLORIDES
distributions in liquid and resin anion exchangers, 17: 6181 (IA-780)
INDIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
INDIUM ISOTOPES In-114
decay of 50 day isomer, search for two-quantum, 17: 7210
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
INDIUM ISOTOPES In-115
gamma reactions (γ,n), 17: 7280
INDIUM ISOTOPES In-116
energy level lifetimes, 17: 7110 (NP-12330(p.152-7))
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
INDIUM ISOTOPES In-122
nuclear properties, 17: 7216
INDOLE,3-(2-AMINOETHYL)-
protective effects against radiation injury, reaction mechanisms, 17: 5931
INDUCTION FURNACES
operation of, for heat treatment of alloys, 17: 6652(R) (DRI-2057)
INDUSTRIAL HYGIENE
permissible levels for fluoride exposure, 17: 5725
INDUSTRIAL MANAGEMENT
material balance in, 17: 5665
optimizing programming effort through machine processing and scheduling, 17: 5654 (HW-SA-2502)
INFECTIONS
effects of inflammation on uptake of gold-198 colloids, 17: 5679
radiation effects on resistance in dogs, 17: 5884
radiation effects on resistance, effects of thyroid hormones, 17: 5885
INFLUENZA VIRUS
development of filamentous forms, 17: 6792(R) (ISS 62/14)
INK
transfer from carbon paper, 17: 6223
INOR-8
corrosion by carbon tetrafluoride, 17: 7562(R) (ORNL-3369)
mechanical properties, 17: 7562(R) (ORNL-3369)
INSECTS
radiation control of grain weevils, 17: 6368
radioisotope accumulation by aquatic, in Columbia River, 17: 5702 (HW-SA-2848)
INSTRUMENTATION
calibration of Bridgman anvils, 17: 6410 (UCRL-9807)
development for reactors, 17: 7546(R) (HW-74761)
development of ultrasonic jack hammer styli, 17: 6201 (ANL-FGF-300)
electric wire leads for, in high-pressure environments, 17: 6408 (UCRL-6531)
reliability improvement by sterilization in monitoring, 17: 6407 (TID-15453)
INSTRUMENTS
design for simultaneous recording of moderator levels and neutron flux variations, 17: 7555(R) (HW-74761(p.11.1-14))
design of impedance void meter, 17: 5656(R) (KR-29)
design of in-pile fission gas release system, 17: 6202 (BMI-X-216)
design of pendulum gravimeter for measuring periodic annual variations in gravitational constant, 17: 6402 (PUC-1962-56)
INTERNAL CONVERSION
mechanisms in, 17: 7103 (NP-12330(p.109-18))
INTESTINE
protection against radiation injuries, by intra-arterial catheterization to produce anoxia, 17: 5667 (BNL-5798)
radiation effects on fatty acid and glucose transport by, in rats, 17: 5933
radioinduced proctitis, 17: 5893
INVERTEBRATES
radioinduced inhibition of caudal regeneration in *Syllis amica*, 17: 5808
IODINE
reactions with inorganic anions to form charge-transfer complexes, 17: 6038 (IA-763)
recombination of atoms of, isotope effects in, 17: 6041 (LAMS-2781)
IODINE COMPOUNDS
protective effects against iodine-131 toxicity in animals, 17: 6005
IODINE ISOTOPES
production in fission process and during nuclear explosions, 17: 6222 (UCLA-499)
sampling materials for airborne, 17: 5754 (PG-Report-408)
IODINE ISOTOPES I-125
properties for renograms, 17: 5728
IODINE ISOTOPES I-131
beta activity of, design of 4π beta plastic scintillator for measurement of, 17: 6459
content in milk, effects of pasture and stored feed consumption by cows on, 17: 6356
decay schemes, 17: 7142 (TID-15548)
decomposition of stored sodium iodide solutions containing, 17: 5693
determination in feces, design of scintillation counter for, 17: 5734
determination in sheep thyroid glands collected in Portugal, spring 1960, 17: 6354
determination in thyroid gland and blood, whole-body counting, 17: 5673(R) (LAMS-2780(p.181-210))
effects on chromosome anomalies of circulating leukocytes in man, 17: 5836
excretion in milk of dairy cattle, effects of mild hyperthyroidism on, 17: 5721
gamma specific emission coefficient, 17: 6431 (CEA-2036)
maximum permissible concentration for inhaled air, 17: 6331
metabolism in rats, effects of Ca EDTA, 17: 5670(R) (LAMS-2780 (p.17-84))
production at Institute of Atomic Energy, apparatus and methods, 17: 6126 (IEA-49)
release by thyroid gland in dairy cattle, effects of forage on, 17: 5723
release from metal-clad uranium dioxide, 17: 6645 (BMI-1604)
sources of ingested, in rats, 17: 6322 (UCLA-499)
toxic effects on animals, protective effects of compounds against, 17: 6005
tumors of thyroid gland induced by chronic ingestion in sheep, 17: 5768 (HW-SA-2493)
uptake by fish in surface water, 17: 5757

uptake by thyroid gland, 17: 5743
use in detection of myocardial infarction, 17: 5685
IODINE ISOTOPES I-132
separation from irradiated uranium, 17: 6172
separation from nitric solution of tellurium, 17: 6173
IODINE ISOTOPES I-133
release from metal-clad uranium dioxide, 17: 6645 (BMI-1604)
IODINE ISOTOPES I-135
release from metal-clad uranium dioxide, 17: 6645 (BMI-1604)
ION BEAMS
materials requirements for ion propulsion, 17: 6544
neutralization of, in electron-bombardment space propulsion systems, 17: 7646
performance of arc-jet, for space propulsion, 17: 7649
propulsion systems using, for control of stationary satellites, 17: 7648
ION EXCHANGE MATERIALS
equilibrium constants and exchange capacities of zeolites, 17: 7550(R) (HW-74761(p.6.1-20))
equilibrium water content, measurement of, 17: 5939 (TID-13384)
preparation by radioinduced reaction of silica gel with acrylic acid or styrene, 17: 6140
ION PUMPS
power supply and control circuit for getter, 17: 6219
ION SOURCES
characteristics of electron-bombardment, for space propulsion uses, 17: 6900
design for Berkeley 88-in. cyclotron, 17: 7406
design of, for generation of helium plasma, 17: 7431 (UCRL-6561)
development of cesium, 17: 6788(R) (EDR-2791)
development of, for accelerator preiniectors, 17: 7340 (BNL-6511 (p.323-34))
location in Berkeley 88-inch cyclotron, 17: 7389
IONIZATION
in air behind shock waves, rate of, 17: 6773 (AFCRL-62-751)
measurement in bubble and cloud chambers, determination of best value of, 17: 6785 (CERN-62-31)
IONIZATION CHAMBERS
design and performance of, for gamma and x-ray dosimetry, 17: 6471
design for free-air x-radiation measurements, 17: 6792(R) (ISS 62/14)
design of dual, for mixed neutrons and gamma radiation, 17: 6479
design of, for liquid hydrogen, 17: 6747(R) (NP-12364)
design with promethium-147 source for current reference standard, 17: 6461
development of high-temperature, 17: 7542(R) (GEMP-75)
dosimetry at x-ray beam edge in air and water, effects of size on, 17: 6445
ionization measurements in, determination of best value of, 17: 6785 (CERN-62-31)
performance of parallel-plane, 17: 6381 (AD-254402)
use in gamma decay measurements, 17: 6431 (CEA-2036)
IONOSPHERE
disturbance by high-altitude nuclear explosions, 17: 6278
effects of atomic explosions on, 17: 6847
electron distribution in, ground-based measurement of, 17: 6774 (AFCRL-531(I))
electron production in D layer by cosmic radiation, 17: 6927
hydromagnetic wave attenuation in, 17: 6913
ionization in F2 region, decay of distribution of, 17: 6933
spread F development in, following a high-altitude thermonuclear explosion, 17: 6848
IONS
adsorption on metals, emission behavior in low fractional adsorptive coverage, 17: 6803 (UCRL-6389)
electromigration of, in magnetic fields in plasma, 17: 7426 (MATT-92)
electron collisional excitation in stellar atmosphere, 17: 6905
motion in plasma, review of collective, 17: 7490
ranges in materials, determination of, 17: 6820
IRIDIUM
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
surface properties and work function of, effects of adsorbed acetylene, ethane, and ethylene, 17: 6660 (IS-462)
IRIDIUM ALLOYS
Ir–Mo, phase studies, 17: 6668(R) (NMI-9246)
Ir–Nb, phase studies, 17: 6668(R) (NMI-9246)
Ir–Os, superconductivity of solid solutions of, 17: 6860
IRIDIUM ISOTOPES Ir-191
energy levels of deformed, lifetimes of, 17: 7292
IRIDIUM ISOTOPES Ir-192
beta decay scheme for, 17: 7151
decay scheme, 17: 7172
gamma specific emission coefficient, 17: 6431 (CEA-2036
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
IRIDIUM ISOTOPES Ir-193
gamma resonance absorption by, anomalies in, 17: 6879
IRIDIUM ISOTOPES Ir-194
isomeric state, 17: 7201
IRON
corrosion, 17: 6572 (OTS-61-31480)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
determination in zirconium and zirconium alloys, 17: 5946 (AERE-AM-91)
determination of, in uranium using 1,10-phenanthroline, 17: 5962 (PG-Report-345)
determination of, in uranium–fission element alloys, colorimetric, 17: 5978 (TID-15319)
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
mesic atom (μ^-) decay in, anomaly in, 17: 6888
mesons (K) scattering by, amplitudes from 495 Mev/c beam, 17: 6995
metabolism, tracer study using whole-body counting, 17: 5746
Mössbauer effect in, at 4 to 1300°K, 17: 6778(R) (ANL-6603(p.20-46))
neutron capture cross sections, fast, 17: 7606(R) (ORNL-1515)
neutron form factors and spin density distributions for, comparison with Hartree-Fock calculations, 17: 6646 (BNL-5674)
neutron resonance cross sections, 17: 7595(R) (ACNP-62018)
neutron shielding efficiency of, measurement, 17: 7067
nuclear polarization in, method for, 17: 7267(T)
proton reactions (p,d), (p,n), (p,K), (p,n), and (p,t) at 30 Bev, 17: 7259
radiation effects on metabolism of, in mice, 17: 5913(T)
radiation effects on content of, in blood plasma in rabbits, 17: 5826
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
separation of trivalent, by liquid-liquid column extraction from copper and zinc, 17: 6183 (IS-423)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
IRON ALLOYS
analysis for molybdenum, niobium, tantalum, and tungsten, x-ray spectrochemical, 17: 5997
cladding on reactor fuel elements, high-temperature properties of, 17: 7571 (TID-17402)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
corrosion of, in high-temperature water cooled reactors, 17: 6567 (HW-SA-2745)
drilling of super-strength, 17: 6615
high-strength, bibliography on, 17: 6521 (NP-12417)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Al–Fe–Ni, corrosion of, by water above 315°C, 17: 7552(R) (HW-74761 (p.8.1-15))
Al–Fe–U, phase studies, 17: 6722
Co-Fe, cobalt nucleus orientation in, 17: 7115 (NP-12330(p.179-85))
Cr–Cu–Fe–Mo–Ni–Ti, corrosion of, by reactor fuel dissolver solutions, 17: 6566 (HW-SA-2307)
Cr–Fe–Mo–Pu, mechanical properties of, 17: 6511(R) (BMI-1593(Del.))
Cr–Fe–Ni, corrosion by carbon dioxide, 17: 6560 (AAEC/E-98)
Cr–Fe–Ni, corrosion by fused fluorides, 17: 7606(R) (ORNL-1515)
Cr–Fe–Y, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)
Cr–Fe–Zr, corrosion by steam at 750°F, 17: 6561(R) (ARF-2198-34)
Cr–Fe–Zr, corrosion of, oxygen gradients in, 17: 6579
Fe–Mo–Ni–W, coatings for, 17: 6563 (DC-61-7-6)
Fe–Sn–Zr, structures in, 17: 6527 (TID-7625(p.30-41))
Fe–V–Zr, corrosion by steam at 750°F, 17: 6561(R) (ARF-2198-34)
IRON CYANIDES
radiation effects on reactions with hydroxyl radicals in organic solutions,

17: 6165
IRON FILMS
adsorptive properties for stearic acid from hexadecane solution, 17: 6078
IRON IONS
determination in water, colorimetric, 17: 5977 (TID-15070)
IRON(II) IONS
separation from iron(III) by ion exchange, 17: 6453
IRON(III) IONS
separation from iron(II) by ion exchange, 17: 6453
IRON ISOTOPES Fe-54
deuteron reactions (d,t) at 21.6 Mev, 17: 6780(R) (ANL-6603(p.52-5))
IRON ISOTOPES Fe-56
neutron reactions (n,p) on, yields from epithermal and fast, 17: 7306
IRON ISOTOPES Fe-57
decay of, Mössbauer effect in gamma, 17: 5656(R) (KR-29)
IRON ISOTOPES Fe-59
determination in blood, whole-body counting, 17: 5673(R) (LAMS-2780 (p.181-210))
determination in feces, design of scintillation counter for, 17: 5734
use in Fricke dosimeter for low doses, 17: 6453
IRON OXIDES
Al_2O_3–Fe_2O_3–TiO_2, emissivity, 17: 6675(R) (PWA-2128)
Fe_2O_3–TiO_2, emissivity, 17: 6675(R) (PWA-2128)
Fe_2O_3–TiO_2, endurance of coating, 17: 6675(R) (PWA-2128)
IRON PERCHLORATES
reactions with chromium(III)–neptunium(IV) complex in perchloric acid, spectra of, 17: 6074
IRON SILICIDES
thermoelectric properties, 17: 6771 (AD-276005)
IRON SYSTEMS
polarization and Curie temperature of perovskite-type, effects of crystal structure on, 17: 6678 (TID-14508)
graphite-Fe, magnetic susceptibility of, 17: 6531(R) (TID-17504)
graphite-Fe, thermoelectric power in, 17: 6531(R) (TID-17504)
IRRADIATION FACILITIES
addition of 50,000 curies of cobalt-60 to gamma, at Hanford, 17: 7554(R) (HW-74761(p.10.1-6))
design of neutron and gamma radiation, 17: 5780 (USNRDL-TR-583)
IRRADIATION TECHNIQUES
for spheroidal bodies, 17: 6224(P)
ISOLEUCINE
analysis for carbon-14 by continuous scintillation counting, 17: 5709
ISOTOPE EFFECTS
on Beckmann rearrangement, 17: 6065
ISOTOPE SEPARATION METHODS
zone fusion, 17: 6492(T,P) (CEA-tr-A-1161)

J

JAPAN
cesium-137 content of people in, methods of measurement of, 17: 5691
JAWS
radiation effects on rat, gamma and 200-kv x, 17: 5867
tumor development in, after radiotherapy of fibrous dysplasia, 17: 5866
JEEP REACTOR
operation of, April to June 1962, 17: 5656(R) (KR-29)
JEEP REACTOR-II
design and construction progress, April to June 1962, 17: 5656(R) (KR-29)
JOINTS
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))

K

KEROSENE
analysis for octane through pentadecane by vapor-phase chromatography, 17: 6195
analysis of mixture of, with tributyl phosphate for 1-butanol using infrared absorption spectrometry, 17: 5973 (PG-Report-406)
analysis of mixtures of, with tributyl phosphate for dibutyl phosphoric acid using infrared spectrometry, 17: 5971 (PG-Report-402)
analysis of mixtures with tributyl phosphate for butex by infrared absorption spectrometry, 17: 5975 (PG-Report-414)
KETENE
radioinduced polymerization, 17: 6155
KETONES
alcohol-diethyl ether-ketone, effects of composition on chromatographic separation of rare earths, 17: 6009
α-diazo, proton abstraction and terminal addition mechanisms, deuterium exchange reactions, 17: 6067
KIDNEYS
arsenic-72 dosimetry in, calculation of, 17: 5735
homograft reactions, 17: 5762(R) (AD-276039)
radiation effects on histology and function in rabbits, 17: 5904
renograms of, properties of iodine-125 for labeled hippuran, 17: 5728
KILNS
testing, 17: 7550(R) (HW-74761(p.6.1-20))
KRYPTON IONS
reactions with copper, gold, and graphite at 100 to 30,000 ev, yields of secondary ions from, 17: 7268
KRYPTON ISOTOPES Kr-83
lifetimes of low-energy M1 transitions in, 17: 7256
KRYPTON ISOTOPES Kr-85
release from metal-clad uranium dioxide, 17: 6645 (BMI-1604)
uses as universal tracer, 17: 6364 (NYO-720)
KRYPTON ISOTOPES Kr-87
release from metal-clad uranium dioxide, 17: 6645 (BMI-1604)

L

LA CROSSE BOILING WATER REACTOR
hazards summary, 17: 7596 (ACNP-62574)
LABORATORY EQUIPMENT
design of adsorption systems for remote radiochemistry, 17: 5942 (UCRL-9659)
design of radioisotope container opener, 17: 6214
LACTATES
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
preparation and properties of rare-earth, 17: 6039 (IS-445)
LANGUAGE
research programs on mechanical translation of, 17: 6801(R) (TID-17303)
LANTHANUM
determination in minerals and rocks, spectrographic, 17: 6008
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
separation from calcium by ion exchange, 17: 6180 (IA-769)
separation from neodymium and yttrium, effects of solvent mixture on chromatographic, 17: 6009
separation from praseodymium by double complexation and replacement, 17: 5986
separation of, chromatographic, 17: 6019
LANTHANUM ACETATES
preparation of anhydrous, by desolvation, 17: 6082
LANTHANUM CARBIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)
LANTHANUM CHELATES
with 2-hydroxybenzophenone, emission spectra, 17: 6085
LANTHANUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
LANTHANUM ISOTOPES
alpha decay systematics for, 17: 7199
LANTHANUM ISOTOPES La-137
lifetimes of low-energy M1 transitions in, 17: 7256
LANTHANUM ISOTOPES La-140
tracer applications in industry, 17: 6372
tracer use in subterranean water flow measurements, 17: 6377
LANTHANUM NITRATES
hydrolysis in dilute solution, 17: 6079
LANTHANUM OXIDES
separation from cerium oxides by distillation in solar furnace, 17: 6069
stability, 17: 6664 (MND-M-2346)
CaO–La_2O_3–SiO_2, phase studies, 17: 6101
LANTHANUM OXYTELLURIDES

preparation and properties, and crystalline structure, 17: 6068
LEAD
corrosion, 17: 6572 (OTS-61-31480)
critical constants and temperature range of liquid, 17: 6711
determination in nickel steel and electro-etch residues, activation, 17: 5984
effects of liquid, on reactor materials, 17: 7606(R) (ORNL-1515)
fabrication of shielding, 17: 6604
gamma pair production cross sections for, 17: 7116 (NP-12330(p.186-92))
light absorption by vaporous, relations with thermodynamic properties, 17: 6802 (TID-17348)
neutron scattering at 84 Mev, experimental and theoretical data on, 17: 7266
neutron shielding efficiency of, measurement, 17: 7067
neutron total cross sections at 14 Mev, 17: 7095 (NP-12330(p.61-5))
proton reactions at high energies, formation of astatine-207 and -209 in, 17: 7276
LEAD ALLOYS
Pb–Na, corrosive effects on Inconel and stainless steel, 17: 7606(R) (ORNL-1515)
LEAD COMPLEXES
with arsenazo III, formation mechanism of, 17: 6005
LEAD ISOTOPES Pb-204
gamma spectra of, E4 cross-over transition probability in, 17: 7196
LEAD ISOTOPES Pb-206
energy level configurations in, doublets from, 17: 7105 (NP-12330 (p.122-5))
neutron inelastic scattering by, energy level excitation in, 17: 7099 (NP-12330(p.86-94))
LEAD ISOTOPES Pb-207
gamma reactions (γ,p), 17: 7289
neutron inelastic scattering by, energy level excitation in, 17: 7099 (NP-12330(p.86-94))
LEAD ISOTOPES Pb-208
gamma reactions (γ,d), (γ,pn), and (γ,p), 17: 7289
neutron inelastic scattering by, energy level excitation in, 17: 7099 (NP-12330(p.86-94))
nuclear properties of, calculation of, 17: 7249
LEAD ISOTOPES Pb-210
separation from bismuth-210 and polonium-210 in nitric and perchloric acids, electrophoretic, 17: 6153
LEAD ISOTOPES Pb-212
internal conversion coefficients in decay of, 17: 6823
LEAD SYSTEMS
Bi–Pb–Te, properties as thermocouple, 17: 7642(R) (AD-276092)
LEAK DETECTORS
design of, for heavy-water reactors, 17: 5656(R) (KR-29)
for tritium, 17: 6390 (DP-198)
LEAKS
design of standard, 17: 6427(P)
detection using sodium-24, 17: 6376
LECTURES
on theory of weak interactions, 17: 6962(T) (AEC-tr-5226)
LEUCINE
analysis for carbon-14 by continuous scintillation counting, 17: 5709
LEUKEMIA
case histories in early radiologists, 17: 5804
effects on peroxidase activity of granulocytes, 17: 5811
incidence in children exposed to diagnostic radiography *in utero*, 17: 5803
incidence in persons receiving frequent chest roentgenography, 17: 5816
radioinduced after injection of strontium-90 in mice, 17: 5907
therapeutic effects of extracorporeal irradiation of blood, 17: 5847
therapy using bone marrow transfusions in man, 17: 5921
LEUKOCYTES
iodine-131 effects on chromosome anomalies of circulating, in man, 17: 5836
peroxidase levels after irradiation and in leukemias, 17: 5811
radiation effects on phagocytic activity, 17: 5884
radiation effects on morphology of granulocytes, whole-body exposure, 17: 5797
radiation effects on morphology of granulocytes, 17: 5798
radiation effects on chromosones of, in therapy for thyrotoxicosis, 17: 5845
radioinduced changes in, correlation with leukopenia in acute radiation sickness in rabbits, 17: 5853
tissue culture methods for human and monkey, 17: 5676 (SAM-TDR-62-99)
LEUKOPENIA
development in acute radiation injuries, 17: 5853
LID TANK FACILITY
shielding material testing, 17: 7606(R) (ORNL-1515)
LIGHTWEIGHT AGGREGATES
mixing conditions, tracer study of, 17: 6374
LINEAR ACCELERATORS
beam observations in Rutherford proton, 17: 7330 (BNL-6511 (p.235-60))
beam transport system for injection into FFAG accelerator, 17: 7336 (BNL-6511(p.294-302))
conference on high-energy, 17: 7308 (BNL-6511)
design and operation of Rutherford proton, 17: 7311 (BNL-6511(p.19-37))
design aspects of cryogenic, 17: 7327 (BNL-6511(p.206-8))
design aspects of stepped-phase-velocity, 17: 7328 (BNL-6511 (p.209-23))
design aspects of stepped-phase-velocity, 17: 7329 (BNL-6511 (p.224-34))
design for meson (π) research, feasibility of, 17: 7319 (BNL-6511 (p.124-7))
design of long iris-loaded, 17: 7320 (BNL-6511(p.128-61))
design of long iris-loaded, 17: 7323 (BNL-6511(p.174-83))
design of particle debunchers for high-energy injection, 17: 7332 (BNL-6511(p.267-73))
design of proton, for use as ZGS injector, 17: 7310 (BNL-6511(p.7-18))
design of secondary beam handling system and experimental area for high-intensity proton, 17: 7317 (BNL-6511(p.101-9))
design of 20-Mev, for use as Bevatron injector, 17: 7309 (BNL-6511(p.1-6))
design of 200-Mev, for use as FFAG injector, 17: 7315 (BNL-6511 (p.76-97))
design of 225-Mev drift tube, 17: 7313 (BNL-6511(p.50-64))
design of 600- to 1000-Mev proton, 17: 7316 (BNL-6511(p.98-100))
design technology of superconducting, 17: 7326 (BNL-6511(p.204-5))
deuteron acceleration in, 17: 7335 (BNL-6511(p.289-93))
development of beam bunchers for, 17: 7331 (BNL-6511(p.261-6))
development of iris-loaded wave guides for, 17: 7322 (BNL-6511 (p.171-3))
development of polarized proton sources for 68-Mev, 17: 7341 (BNL-6511(p.335-7))
development of superconducting proton, 17: 7324 (BNL-6511(p.184-95))
development of superconducting, 17: 7325 (BNL-6511(p.196-203))
drift tube alignment on AGS injector, 17: 7343 (BNL-6511(p.381-5))
ion sources for preinjector, 17: 7340 (BNL-6511(p.323-34))
magnet focusing between sections of, 17: 7333 (BNL-6511(p.274-82))
particle orbits in, at 200 Mev to 2 Bev, effects of machine fabrication errors on, 17: 7321 (BNL-6511(p.162-70))
phase oscillation and transverse motion of protons in, 17: 7314 (BNL-6511(p.65-75))
radiofrequency power supplies for, development of, 17: 7337 (BNL-6511(p.303-5))
shielding of 500-Mev to 1-Bev, 17: 7318 (BNL-6511(p.110-23))
vacuum system design and operation for 50-Mev, 17: 7339 (BNL-6511(p.318-22))
LIPIDS
radiation effects on metabolism in brain, whole-body exposure, 17: 5882
radiation effects on oxidation of, 17: 5821
radiation effects on skin, 17: 5825
LIQUID FLOW
measurement using sodium-24, 17: 6376
LIQUID METAL COOLED REACTORS
design of graphite-moderated power, using sodium, 17: 7622
fission product behavior in, in direct contact core systems, 17: 7611

(TID-14495)
LIQUIDS
particle tracks in, effects of pressure on, 17: 6472
LITHIUM
corrosive effects of liquid, on reactor materials, 17: 7606(R) (ORNL-1515)
corrosive effects on alloys, ceramics, cermets, and pure metals at 1500 to 1900°F, 17: 6570 (ORNL-2674)
uses, 17: 6538
LITHIUM ALLOYS
uses, 17: 6538
LITHIUM CHLORIDES
transfer between heavy and light water, ionic hydration in, 17: 6096
LITHIUM COMPLEXES
with uranyl acetate in aqueous solution, spectra of, 17: 6081
LITHIUM DEUTERIDES
molecular constants of, 17: 6077
LITHIUM FLUORIDE CRYSTALS
radioinduced defects in, transition temperatures for, 17: 6760
LITHIUM FLUORIDES
argon and helium scattering from cleavage plane of, molecular, 17: 6835
neutron capture cross sections, fast, 17: 7606(R) (ORNL-1515)
scattering of argon and helium from cleavage plane of, 17: 6794 (K-1498)
BeF_2–LiF–ThF_4–UF_4–ZrF_4, phase studies, 17: 7562(R) (ORNL-3369)
BeF_2–LiF–ThF_4, phase studies at high temperatures, 17: 7606(R) (ORNL-1515)
BeF_2–LiF–ZrF_4, phase studies of, 17: 7562(R) (ORNL-3369)
LiF–NaF–ZrF_4, corrosive effects of liquid, on nickel and nickel alloys, 17: 6571 (ORNL-TM-411)
LITHIUM HYDRIDES
casting of, proposed method for, 17: 6596 (DC-61-7-27)
meson (π^-) capture by hydrogen in, 17: 7083 (JINR-P-1081)
molecular constants of, 17: 6077
LITHIUM ISOTOPES Li-6
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
gamma reactions (γ,d), mechanisms in, 17: 7185
lithium nucleus reactions (lithium-6), 17: 7251
production in beryllium moderators, 17: 7565(R) (PWAC-161)
proton reactions on, cross sections and Q-values of, 17: 7200
LITHIUM ISOTOPES Li-7
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
energy level of, mean lifetime of first, 17: 7229
energy levels, 17: 7037
lithium nucleus reactions (lithium-6) and (lithium-7), 17: 7251
proton reaction (p,α) at 3.3 to 6.55 Mev, energy levels in, 17: 7179
proton reactions (p,α) at 1 to 3.2 Mev, 17: 7272
LITHIUM ISOTOPES Li-9
decay and production of, 17: 7198
LITHIUM MINERALS
reserves, 17: 6538
LITHIUM NITRATES
transfer between heavy and light water, ionic hydration in, 17: 6096
LITHIUM ORES
reserves, 17: 6538
LITHIUM TUNGSTATES
electrical properties, 17: 6658 (IS-433)
LIVER
arsenic-72 dosimetry in, calculation of, 17: 5735
protective effects in injected fetal cells against radiation injuries in mice, 17: 5810
radiation effects on nucleotide metabolism in, whole-body exposure, 17: 5879
radiation effects on quinone content, 17: 5880
radiation effects on synthesis of albumins, 17: 5928
radiation effects on lipid composition of mitochondria, 17: 5772 (TID-13322)
radiation effects on oxidative phosphorylation in mitochondria of, in rats, 17: 5784
radiation effects on cholesterol and fatty acid synthesis in, in rats, 17: 5792
regeneration in normal and irradiated rats, effects of bone marrow on, 17: 5854
LIVERMORE POOL TYPE REACTOR
operation of, effects of nonsteady-state schedule in, 17: 7636 (UCRL-6761)
LOS ANGELES
atmospheric gamma radiation survey in region of, 17: 6253 (CEX-59.4.16)
geology in region of, 17: 6253 (CEX-59.4.16)
LUBRICANTS
characteristics of, for space application, 17: 6548
development of graphite, 17: 7606(R) (ORNL-1515)
development of molybdenum disulfide, 17: 7606(R) (ORNL-1515)
preparation of radiation-resistant, 17: 6770(P)
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
LUNGS
analysis for neptunium-237, protactinium-233, cobalt-60, zirconium-95, and niobium-95 in human, by whole-body counting, 17: 5704 (TID-12790)
LUTETIUM
determination in minerals and rocks, spectrographic, 17: 6008
neutron cross sections at 0.015 to 0.3 ev, 17: 7078 (IEA-51)
use as spectral index detector, 17: 7549(R) (HW-74761(p.5.1-35))
LUTETIUM ISOTOPES Lu-170
gamma spectrum, 17: 7162
LUTETIUM ISOTOPES Lu-171
gamma spectrum, 17: 7162
LUTETIUM ISOTOPES Lu-174
decay transition probabilities, 17: 7180
LUTETIUM ISOTOPES Lu-175
energy levels of deformed, lifetimes of, 17: 7292
LYMPH CELLS
radiosensitivity of desoxyribonucleic acid synthesis in spleen, 17: 5830
LYMPH SYSTEM
radiation effects on spread of tick-borne encephalitis in, in mice, 17: 5786
LYSINES
analysis for carbon-14 by continuous scintillation counting, 17: 5709

M

MACHINE TOOLS
design of turning tool for beryllium, 17: 6620
MACHINING
book: *Machining Difficult Alloys*, 17: 6608
end milling of U-500 alloy, performance of high-speed steels in, 17: 6614
milling of high-strength steels and heat-resisting alloys, 17: 6612
MAGNESIUM
bibliography on, 17: 6521 (NP-12417)
determination in zirconium alloys, 17: 6020
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
gastrointestinal absorption in sheep, tracer study, 17: 5737
oxidation kinetics in air, nitrogen, and oxygen, 17: 6577
separation from metallic mixture by ion exchange chromatography, 17: 5991
temperature effects on mechanical properties of, cryogenic, 17: 6542
MAGNESIUM ALLOYS
corrosion, 17: 6572 (OTS-61-31480)
thermophysical properties of, 17: 6549
Al–Mg, analysis of, for antimony, 17: 5960 (PG-Report-337)
Al–Mg, analysis of, for cobalt, 17: 5960 (PG-Report-337)
Mg–Mn, analysis of, for antimony, 17: 5960 (PG-Report-337)
Mg–Mn, analysis of, for cobalt, 17: 5960 (PG-Report-337)
MAGNESIUM ALUMINATES
emissivity, 17: 6675(R) (PWA-2128)
MAGNESIUM ISOTOPES Mg-24
alpha reactions (α,γ) on, energy levels from, 17: 7262
MAGNESIUM OXIDE COATINGS
deposition on sodium iodide crystals, 17: 6491(P)
MAGNESIUM OXIDE POWDERS
sintering of, evaluation of procedures in, 17: 6590 (ASD-TDR-62-700)
MAGNESIUM OXIDES
catalytic properties for hydrogen-deuterium exchange, radiation effects, 17: 6086
spectra at 90 and 320°K, cathodoluminescence, 17: 6089

MgO–PuO_2, fabrication and testing, 17: 7547(R) (HW-74761(p.3.1-39))
MgO–UO_2, preparation for irradiation tests, 17: 6536(T,K) (EURAEC-365)

MAGNESIUM SULFATES
transfer between heavy and light water, ionic hydration in, 17: 6096

MAGNET COILS
construction of trim, for Berkeley 88-in. cyclotron, 17: 7407
current setting for Analogue II cyclotron, 17: 7400

MAGNETIC FIELDS
charged-particle behavior in static asymmetric magnetic mirror geometry, 17: 7465
charged-particle behavior in static axially symmetric magnetic mirror and cusp geometries, 17: 7466
deformation of moving, in conductive medium, 17: 6811(T) (FTD-TT-62-981)
design for Analogue II cyclotron, 17: 7399
design for ORIC, computer programs for, 17: 7385
design for Univ. of Colorado cyclotron, 17: 7372
design for 450 Mev spiral ridge cyclotron, 17: 7397
distribution in theta pinch, 17: 7477
effect on 21-cm hydrogen line splitting of galactic, 17: 6910
effects of imperfections on orbit stability in cyclotrons, 17: 7383
effects of nonarcing axial, on plasma stability, 17: 7428 (NP-12342)
effects on the light characteristics of a pulsed discharge in argon, 17: 7486
electric discharge breakdown in, with perpendicular electric field, 17: 6821
hydromagnetic wave propagation through ionized gas in, 17: 7472
intensity variations of, in Compton Spectrometer, design of control system for, 17: 6438 (TID-15530)
interactions with shock-heated air plasma, 17: 7491
interactions with superconductors, 17: 6784 (CERN-62-30)
measurement of, design of Hall probe assembly for, 17: 7350 (UCRL-10085)
measurements for AERE spiral ridge cyclotron, 17: 7374
measurements for ORIC, 17: 7375
measurements of, for Berkeley cyclotron, 17: 7373
quantization of, in association with electric currents, 17: 6804 (UCRL-6630-T)
shape measurements for AVF cyclotrons, 17: 7387
shaping for cone in Berkeley cyclotron, 17: 7390
shaping for Univ. of Manitoba cyclotron, 17: 7368
shimming of sector-focused isochronous cyclotrons, 17: 7362
trim-coil currents for cyclotron, computer programs for, 17: 7386

MAGNETIC MATERIALS
neutron scattering in, effect of spin-spin interaction on, 17: 7072(T)
polarization of nuclei in, 17: 7267(T)
theory of magnetothermomechanics, 17: 6859

MAGNETIC MIRROR MACHINES
plasma instabilities in, 17: 7448

MAGNETIC MIRRORS
charged particle behavior in static asymmetric, 17: 7465
charged particle behavior in static axially symmetric, 17: 7466

MAGNETIC PROPERTIES
theory of magnetothermomechanics, 17: 6859

MAGNETIC RECORDING SYSTEMS
for strain gages, 17: 6405 (SCTM-364-61(73))

MAGNETIC SUSCEPTIBILITY
measurement for paramagnetic compounds in dilute solution, 17: 6884
measurement of, design of balance for, 17: 6385 (CEA-2187)

MAGNETOHYDRODYNAMIC CELLS
characteristics and power balance of, 17: 6817
design of permanent insulating duct walls for, 17: 6849
development and closed-loop operation, 17: 6772(R) (AD-276597)
developments for space applications, 17: 6551
efficiency of, effects of channel profiling on, 17: 6812(T) (FTD-TT-62-1181)
field variables in segmented-wall, method for analysis of, 17: 6796 (NP-12332)

MAGNETOHYDRODYNAMICS
analysis of ionizing fronts in, 17: 7433 (UCRL-9971)
equations of relativistic, derivation of, 17: 6829
flows past wedges in, analysis of inviscid supersonic, 17: 6898
Hamiltonian and Lagrangian methods in, 17: 7430 (UCRL-6387)
hypersonic shock layer support in, 17: 6783 (BSD-TDR-62-337)
plasma collective properties in, review of, 17: 7490
turbulence in, review, 17: 7492
turbulent flow of electroconductive liquid in presence of magnetic field, 17: 7442
Zemplen theorem in, 17: 6827

MAGNETOMETERS
use of polycrystalline bismuth wire, for high fields at low temperatures, 17: 6424

MAGNETS
aberrations and quadrupoles for paraxial rays in bending, 17: 6782 (ANL-6611)
beam handling for Berkeley cyclotron, 17: 7409
design features for spiral ridge cyclotrons, 17: 7355
design for cyclotron beam extraction, 17: 7403
design for large isochronous cyclotron, 17: 7396
design for UCLA spiral-ridge cyclotron, 17: 7353
design for Univ. of Mich. cyclotron, 17: 7365
design for Univ. of Mich. cyclotron beam handling system, 17: 7367
design for Univ. of Milan AVF cyclotron, 17: 7361
design for 700 Mev cyclotron, 17: 7398
design of Philips AVF cyclotron, 17: 7363
design of quadrupole, analog computer for, 17: 7346 (TID-17429)
power supply for 88-in. cyclotron, 17: 7412
regulators for ORIC, 17: 7376

MALATES
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)

MALEIC ANHYDRIDE
reactions with cyclopentadiene, secondary deuterium isotope effect in, 17: 6122

MALONIC ACID, DERIVATIVES
oxidative effects of inorganic, on metabolism of *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)

MAN
analysis for neptunium-237, protactinium-233, cobalt-60, zirconium-95, and niobium-95 in human, by whole-body counting, 17: 5704 (TID-12790)
arsenic-72 dosimetry in, calculation of, 17: 5735
book: *Radiation and Health*, 17: 5906
calcium and strontium metabolism in, bibliography on, 17: 5747
calcium metabolism in bone, tracer study, 17: 5742
content of potassium-40 and cesium-137, whole-body counting, 17: 5672(R) (LAMS-2780(p.130-80))
fission product metabolism, 8-year survey of Marshall Islanders exposed to local fallout, 17: 5699 (BNL-6503)
iodine-131 effects on chromosome anomalies of circulating leukocytes in, 17: 5836
radiation dose from diagnostic radiology, 17: 6348
radiation effects on, in space, 17: 5868
radiation effects from whole-body exposure to doses of 400 to 450 rads in 8 hours, 17: 5874
radiation effects on bone marrow cells in atomic bomb survivors, 17: 5785
radiation effects on ear in, 17: 5834
radiation effects on receptor apparatus of cutaneous and visual analyzers in, 17: 5851
radiodiagnosis in, effects on chromosome aberrations in, 17: 5846
radiotherapy of malignant neoplasms in, effects on peripheral blood picture in, 17: 5850
screening for neutron exposure after radiation accident, 17: 5775 (TID-14529)
strontium movement in skeleton of, 17: 5712
strontium-90 content in bones in, effects of age on, 17: 5714
strontium-90 metabolism in bones in, 17: 5715
tissue cultures of leukocytes, 17: 5676 (SAM-TDR-62-99)

MANGANESE
determination in nickel steel and electro-etch residues, activation, 17: 5984
deuteron reactions (d,t) at 21.6 Mev, 16: 6780(R) (ANL-6603(p.52-5))
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095

neutron form factors and spin density distributions for, comparison with Hartree-Fock calculations, 17: 6646 (BNL-5674)
nuclear polarization in, method for, 17: 7267(T)
MANGANESE ALLOYS
Cu–Mn–Ni, corrosion by nitric acid, 17: 6192(T,R) (EURAEC-382)
Mg–Mn, analysis of, for antimony, 17: 5960 (PG-Report-337)
Mg–Mn, analysis of, for cobalt, 17: 5960 (PG-Report-337)
Sb–Mn, pyrophoricity, 17: 6693(T) (AEC-tr-5544)
MANGANESE ISOTOPES
separation of, radiochemical, 17: 6128 (ORNL-TM-438)
MANGANESE ISOTOPES Mn-50
decay scheme, 17: 7138 (PUC-1962-61)
MANGANESE ISOTOPES Mn-54
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
MANGANESE ISOTOPES Mn-55
nuclear properties of, shell model calculation of, 17: 7240
nuclear quadrupole moment, 17: 7275
nuclear structure of, shell-model calculations for, 17: 7145 (UCRL-6404)
proton reactions (p,n), cross section relations with energy, 17: 7144 (TID-17357(Pt.III))
MANGANESE ISOTOPES Mn-56
equipment for research on, 17: 6170
gamma specific emission coefficient, 17: 6431 (CEA-2036)
tracer applications in industry, 17: 6372
MANGANESE SILICIDES
thermoelectric properties, 17: 6771 (AD-276005)
MANNOSE
recrystallization of D-mannose-1-t phenylhydrazone, isotope effects in, 17: 6118
MARITIME REACTORS
design and development of 630 A, 17: 7599(R) (GEMP-160)
MARSHALL ISLANDS
medical survey of natives exposed to local fallout, eight-year summary, 17: 5699 (BNL-6503)
MASS SPECTROMETERS
design of small bakeable, 17: 6379 (61-RL-2501G(Rev.))
operation of radiofrequency, with parabolic potential, 17: 6416
MASS TRANSFER
determination of rates of, profilometric, 17: 6236
in fixed and fluidized beds, 17: 6232
MATERIALS TESTING
eddy-current equipment and techniques for, 17: 7555(R) (HW-74761 (p.11.1-14))
nondestructive methods development for evaluation of ceramic-metal bonds, 17: 6509(R) (ARF-1213-5)
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
MATHEMATICS
data smoothing, principles of circuits for, 17: 6505 (TID-17315)
equations for conversion relations, of partially ionized gases, 17: 6786 (DCAS-TDR-62-133)
gauge invariance and correlated boson fields, 17: 6969
Goldstone perturbation expansion, corrections to, 17: 6497 (NP-12304)
Green's function in, derivation of biharmonic, 17: 6846
solution of exterior boundary value problems for the wave equation, 17: 6503 (TID-14920)
MATTER
electron emission by, theory for secondary, 17: 6832
search for anti-, in cosmic radiation and space, 17: 6915(T)
transport properties of, statistical theory for, 17: 6818
MECHANICS
Green's function in, derivation of biharmonic, 17: 6846
transport properties of matter in classical statistical, 17: 6818
MERCURY
cesium and potassium scattering by, velocity dependence of differential cross sections for, 17: 6836
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
separation of, radiochemical and vacuum distillation, 17: 6135
MERCURY CHLORIDE COMPLEXES
crystal structure of mercury chloride 2-4-6 trioxo 1-3-5 trimethyl-hexa-hydrotriazene, 17: 6792(R) (ISS 62/14)
MERCURY ISOTOPES Hg-198
scattering resonances in, interference between, 17: 7109 (NP-12330 (p.147-51))
MERCURY ISOTOPES Hg-203
gamma specific emission coefficient, 17: 6431 (CEA-2036)
localization in brain tumors, diagnostic applications, 17: 5841
MERCURY SALTS
protective effects against iodine-131 toxicity in animals, 17: 6005
MESIC ATOMS
decay of μ^-, of transition metals of the iron group, anomaly in, 17: 6888
magnetic moment of (μ^-), 17: 7213
meson (μ^-) decay rates in, theory for, 17: 6968
MESON BEAMS
production in accelerators, 17: 7391
production of, shielding requirements for, 17: 7393
production with sector-focused cyclotron, 17: 7394
production with various accelerators, 17: 7392
production with 700 Mev cyclotron, 17: 7398
MESONS
decay probabilities, 17: 7022
interactions with hyperons, Yukawa-type, 17: 7008
interactions with nucleons through large angles, Regge fermion poles in, 17: 7034
mass of a complex vector field, 17: 7519
production of M, in meson (π^-)-proton reactions, 17: 7014
search for 310-Mev mass neutral, 17: 6792(R) (ISS 62/14)
vector, electromagnetic properties of charged, 17: 6961 (UCRL-9889)
MESONS (π)
decay of, products and branching ratios for, 17: 6998
production and properties in meson (π^+)-proton interactions, 17: 6997
MESONS (K)
interactions of, resonances in, 17: 7043
production by proton reactions with aluminum, beryllium, and iron at 30 Bev, 17: 7259
production in antiproton-proton annihilation, 17: 6947 (IA-768)
production of double resonant K^*, spin determination in, 17: 7000
MESONS (K^-)
capture by nuclei for nuclear structure measurements, 17: 7232
MESONS (K^0)
decay of, CP invariance and K_1 regeneration in, 17: 6995
interference phenomena in $K^0\bar{K}^0$ systems, 17: 7026
pair production by mesons (π^-) in bubble chambers, resonance in, 17: 7039
MESONS (K^+)
charge exchange in hydrogen at 1.12 and 1.45 bev/c, cross sections for in elastic, 17: 6966
decay of, evidence for $K^+ \rightarrow \pi^+ + \pi^- + e^+ + \nu$, 17: 6999
interactions with protons, production of meson (K^*) resonance in, 17: 7000
photoproduction near the threshold, 17: 7051
production in neutrino interactions with protons, cross sections for, 17: 6953 (LNF-62/89)
MESONS ($K_{\mu 3}$)
decay of, form factors in, 17: 6953 (LNF-62/89)
MESONS ($K_{\mu 2}$)
decay of, single-loop four-point diagrams in, 17: 6944 (BNL-5528)
MESONS (μ)
capture in chlorine-35 and chlorine-37, shell model calculation of rates for, 17: 7274
decay ($\mu \rightarrow e + \nu$), neutral currents in, 17: 7032
decay ($\mu \rightarrow 3e$), neutral currents in, 17: 7032
electron-photon shower production by, at high energies, 17: 7044
pair production of, spin correlation in, 17: 6952 (LNF-62/75)
production in electromagnetic electron interactions, 17: 7009
production of pairs of, by electron-positron annihilation, 17: 7031
MESONS (μ^-)
capture by carbon-12, partial and total probabilities of, 17: 6986
capture by protons, radiative, 17: 7047
decay, 17: 6962(T) (AEC-tr-5226)
decay in mesic atoms of transition metals of the iron group, anomaly in, 17: 6888
decay rates in mesic atoms, theory for, 17: 6968
magnetic moment of, bound in field of nucleus, 17: 7213

scattering in nuclear emulsions, elastic, 17: 6988
MESONS (μ^+)
depolarization in solids, 17: 7046
MESONS (ω)
decay of, products and branching ratios for, 17: 6998
production and properties in meson (π^+)-proton interactions, 17: 6997
MESONS (ω^0)
photoproduction from hydrogen, cross sections for, 17: 6792(R) (ISS 62/14)
MESONS (π)
decay of, polarization effects in radiative, 17: 7021
interactions in gamma-meson (ρ) systems, constants for, 17: 7001
interactions with nucleons, spin rotation effects in, 17: 6985
interactions with mesons (π) at low energies, resonances in, 17: 6987
interactions with mesons (π), high-energy behavior in elastic, 17: 7003
interactions with nucleons, dispersion relations in, 17: 7010
interactions with nucleons, effect of π-π interaction on s and p waves of, 17: 7024
interactions with nucleons, interaction constant for, 17: 7027
interactions with mesons (π), analytic properties of partial amplitudes in, 17: 7028
interactions with mesons (π) and protons, role of vector mesons in elastic, 17: 7045
interactions with nucleons, gauge groups and symmetries of the isospace associated with nonrelativistic rotator, 17: 6970
mass measurement from nucleon-nucleon scattering, 17: 7027
production by neutrino-nucleon interactions, amplitudes of, 17: 7023
production by proton reactions with aluminum, beryllium, and iron at 30 Bev, 17: 7259
production in antiproton-proton annihilation, 17: 6947 (IA-768)
production in meson (π^-)-proton interactions at 7.2 Bev, π-π interactions in multiple, 17: 7035
production in nucleon-nucleon interactions at high energies, semi-phenomenological model for, 17: 6984
production of beams, 17: 7391
reactions in bubble chambers, meson (K^0) pair production in, 17: 7039
scattering of, measurement of multiple, in energy-loss interactions, 17: 6954 (NP-12259)
MESONS (π^-)
capture by helium-4, 17: 6979
capture by hydrogen, in chemical compounds, 17: 7083 (JINR-P-1081)
capture in complex nuclei, 17: 6792(R) (ISS 62/14)
interactions with antiprotons, $\bar{N}_1^*$ anti-isobar production in, 17: 7002
interactions with protons at high energy, cross sections of, 17: 7013
interactions with protons, mesons (M) production in, 17: 7014
interactions with the Coulomb field of the nucleus at 2.8 Bev/c, production of mesons (π^0) by, 17: 7020
interactions with protons at 7.2 Bev, π-π interactions in multiple production of mesons (π) in, 17: 7035
interactions with protons at 152 and 226 Mev, elastic, 17: 6977
interactions with protons, one-pion-exchange contributions to, 17: 6980
photoproduction from nuclei, 17: 6975
MESONS (π^0)
gamma production at 450 and 600 Mev, 17: 7007
photoproduction from hydrogen, design of apparatus for measuring cross sections for, 17: 6792(R) (ISS-62/14)
photoproduction in deuterium and hydrogen, 17: 7036
production by mesons (π^-) at 2.8 Bev/c in the Coulomb field of the nucleus, 17: 7020
MESONS (π^+)
half life in circular and rectilinear trajectories, 17: 6792(R) (ISS 62/14)
interactions with protons, resonances in, 17: 6997
interactions with protons, N_1^* isobar production in, 17: 7002
interactions with protons at high energy, cross sections of, 17: 7013
interactions with protons, threshold singularities in total cross sections for $K^+\Sigma^+$ formation, 17: 7033
interactions with protons, one-pion-exchange contributions to, 17: 6980
photoproduction from hydrogen, ρ,γ,π coupling constant from, 17: 7001
reactions (π,3α) with carbon-12 at 80 Mev, 17: 7288
MESONS (ρ)
interactions in gamma-meson (π) systems, constants for, 17: 7001
production and properties in meson (π^+)-proton interactions, 17: 6997
METABOLISM
bibliography on calcium and strontium, in animals and man, 17: 5747
radiation effects on oxidative, in fats, 17: 5821
tracer studies, evaluation of kinetic data, 17: 5726
METABORIC ACIDS
spectra of vapor of, infrared, 17: 6045(R) (RAD-SR-62-251)
METAL COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
METAL COMPOUNDS
analysis of powders of, for water by vacuum distillation, 17: 5963 (PG-Report-350)
METAL POWDERS
analysis of, for water by vacuum distillation, 17: 5963 (PG-Report-350)
fabrication of, by pressing, development of theory for, 17: 6603(T) (IPRS-16573)
METALLIC FILMS
thermoelectric power of thin, 17: 6700(T) (UCRL-Trans-892(L))
METALLOGRAPHY
conference on, at Armour Research Foundation, Jan. 14–15, 1959, 17: 6524 (TID-7625)
METALLURGY
book: *Uranium Metallurgy. Vol. I. Uranium Process Metallurgy*, 17: 6539
production of styli for removal of microscopic inclusions, 17: 6201 (ANL-FGF-300)
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
METALS
analysis by spectroscopy of x rays produced by beta particles, 17: 5982(T) (CEA-tr-X-461)
analysis for hydrogen by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
analysis for nitrogen by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
analysis for oxygen by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
analysis of liquid, for impurities using resistivity meter, 17: 6382 (APDA-149)
behavior at high temperatures, 17: 6669 (NP-12295)
bibliography, 17: 6518 (NP-12288)
bond mechanisms of, in relation to structure, 17: 6686 (UCRL-10012)
dispersion-strengthened, bibliography on, 17: 6677 (RISO-48)
entropy and Seebeck coefficient changes in mixing of liquid, 17: 6044 (NP-12311)
joining, conference, 17: 6627
lattice defects in, 17: 6669 (NP-12295)
machining, electronic techniques for, 17: 6598 (SCTM-39-62(25))
positron annihilation rates in, semi-empirical correlation of, 17: 6960 (UCRL-9793)
purification of, by chemical processes, survey of, 17: 6515 (IS-394)
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
radiation effects on, 17: 6733 (62-GC-209)
radiation effects on, 17: 6768
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
sealing of, to dielectrics, 17: 6676(R) (RADC-TDR-62-401)
separation by solvent extraction using dialkylphosphoric acids, mechanism of, 17: 6197
separation of di-, tri-, and tetravalent, by solvent extraction, synergism in, 17: 6050 (TID-15323)
surface tension of liquid, expression as function of temperature for, 17: 6708
thermodynamic properties of, at high temperatures, 17: 6043 (NP-12310)
thermodynamic stability of, in relation to structure, 17: 6686 (UCRL-10012)
METEORITES
analysis of, for tritium, 17: 5947(R) (AFCRL-62-295)
argon isotope content of, bibliography on, 17: 6270(R) (NYO-10325)
calcium isotope content of, bibliography on, 17: 6270(R) (NYO-10325)
chromium isotope occurrence in, 17: 6257 (IS-438)
composition of, in relation to early history of solar system, 17: 6902 (EFINS-62-50)
ruthenium isotopic composition in iron, 17: 6289
strontium isotope content of, bibliography on, 17: 6270(R) (NYO-10325)

METHACRYLAMIDE POLYMERS
viscosity of, 17: 6129 (PAN-308/XVII)
METHACRYLIC ACID, METHYL ESTER
polymerization of, graft, 17: 6511(R) (BMI-1593(Del.))
METHANE
analysis of atmospheric, for tritium, 17: 5947(R) (AFCRL-62-295)
labeling with tritium, mass spectrometric study of mechanisms in, 17: 6781(R) (ANL-6603(p.57-73))
mass spectra of volatile, 17: 6791 (IS-424)
viscosity of deuterated and normal liquid, at 90 to 115°K, 17: 6094
METHANE, DICHLORODIFLUORO-
meson (π^-) reactions in liquid, meson (K^o) pair production in, 17: 7039
MICE
immune reactions to injected hematopoietic tissue in irradiated, 17: 5802
radiation effects on, lethal gamma, 17: 5863
radiation effects on hematopoietic organs and hypophysis in, 17: 5872
radiation effects on embryonal development, 17: 5897
radiation effects on iron metabolism in, 17: 5913(T)
radiation effects on active and passive immunity to bone marrow transplantations in, 17: 5916
radiation effects on spread of tick-borne encephalitis in lymphatic system in, 17: 5786
radiation effects on prolan stimulation of ovaries, 17: 5817
radiation injuries in, protective effects of acylated derivatives of MEA against, 17: 5924
radiosensitivity, effects of previous exposure to fission neutrons of gamma radiation, 17: 5776 (TID-14698)
radiosensitivity, effects of ancestral radiation exposure, 17: 5777 (TID-15181)
radiosensitivity, effects of various variables, 17: 5671(R) (LAMS-2780 (p.85-129))
strontium-90 excretion in, effects of aluminum citrate on, 17: 5744
tumor growth in, effects of x-irradiated cell injections on, 17: 5824
MICHIGAN RESEARCH REACTOR
development and operation of, 17: 6132(R) (TID-17272)
MICROORGANISMS
lysis of *B. aegyptius*, effects of hyaluronidase on, 17: 6792(R) (ISS 62/14)
ribonucleic acid and ribosome molecular properties and thermostability in thermophilic, 17: 6792(R) (ISS 62/14)
synchronous growth of several strains, 17: 5674(R) (LAMS-2780(p.211-45))
MICROSCOPES
design and operation of reflecting, for high temperature use, 17: 6406 (TID-13148)
operation of ultrasonic, principles for, 17: 6792(R) (ISS 62/14)
MICROSCOPY
Cintel flying spot, 17: 6529 (TID-7625(p.52-62))
MICROWAVE EQUIPMENT
design of 8-MH, ultrasonic waveguide, 17: 6792(R) (ISS 62/14)
development of iris-loaded guide configuration for accelerator traveling waves, 17: 7322 (BNL-6511(p.171-3))
performance of, for gas discharge duplexers, 17: 6403(R) (RADC-TDR-62-254)
MICROWAVE SPECTROSCOPY
development, 17: 6801(R) (TID-17303)
MICROWAVES
emission by cold plasma at cyclotron frequencies, 17: 7435(T) (AEC-tr-5564)
emission by hot-cathode-discharge plasma, 17: 7452
emission from non-Maxwellian plasmas, 17: 7469
emission from planet Mercury, 17: 6907
emission from solar corona, source of, 17: 6906
measurements on precursor afterglow in shock tube, 17: 7422 (AWRE-O-11/62)
MILK
cesium-137 content of dried, vegetation zone relation to, 17: 5752 (HW-SA-2337)
contamination by fall-out, protection from harmful effects of, 17: 6338
formation, conversion of plasma calcium and phosphorus in dairy cows, tracer study, 17: 5722
iodine-131 content in, effects of pasture and stored feed consumption by cows on, 17: 6356
iodine-131 excretion in, effects of mild hyperthyroidism in cattle on, 17: 5721
radioisotope levels in, 17: 5751(R) (HASL-132)
sampling of, in New Zealand, 17: 5750(R) (DXRL-F6)
strontium content in breast and bottled, effects on babies, 17: 5730
strontium-90 content in, in United Kingdom, 1960, 17: 6363
strontium-90 content in, in New Zealand, 17: 5750(R) (DXRL-F6)
strontium-90 levels in, mathematical model of effects of transport mechanisms on, 17: 6353
MINERALS
analysis for rare earths, spectrographic, 17: 6008
argon isotope content of, bibliography on, 17: 6270(R) (NYO-10325)
calcium isotope content of, bibliography on, 17: 6270(R) (NYO-10325)
strontium isotope content of, bibliography on, 17: 6270(R) (NYO-10325)
MITOCHONDRIA
radiation effects on lipid composition in rat liver, 17: 5772 (TID-13322)
radiation effects on oxidative phosphorylation in isolated liver, in rats, 17: 5784
MITOSIS
radiation effects, 17: 5876
MOLECULAR BEAMS
equipment for gas-solid reactions, 17: 6520(R) (NP-12373)
scattering of argon and helium, from lithium fluoride cleavage plane, 17: 6794 (K-1498)
MOLECULES
dissociation and energy-transfer in, effects of electronic coupling on, 17: 6151
electron capture by theory of dissociative attachment in, 17: 6862
electron scattering by, effects of negative-ion states on theory of, 17: 7076 (BNL-5801)
MOLTEN SALT REACTOR EXPERIMENT
design and development of, 17: 7562(R) (ORNL-3369)
MOLYBDATES
spectra of europium and terbium ions in, intensities of emission, 17: 6837
MOLYBDENUM
alloying effects on zirconium alloy corrosion, 17: 6581
analysis for zirconium by solvent extraction using cupferron, 17: 6012
bibliography on, 17: 6521 (NP-12417)
cladding, 17: 7571 (TID-17402)
corrosion by lead (liquid) at high temperatures, 17: 7606(R) (ORNL-1515)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
critical magnetic fields in superconducting, down to 0.12°K, 17: 6857
determination in iron and steel alloys, x-ray spectrochemical, 17: 5997
determination in nickel steel and electro-etch residues, activation, 17: 5984
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
electron emission from a clean surface of, by bombardment with low-energy noble gas ions, 17: 6855
heat of sublimation and vaporization of solid, 17: 6093
ion ranges in, determination from collection experiments, 17: 6820
joining by brazing and welding, 17: 6631
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
separation from metallic mixture by ion exchange chromatography, 17: 5991
spectra of, effects of temperature on absorption, 17: 5996
superconductivity of, energy gap and critical field in, 17: 6877
surface properties of, studies by mass spectrometry, 17: 6634 (AFOSR-2273)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
MOLYBDENUM ALLOYS
end milling of U-500, 17: 6614
extrusion, 17: 6589 (ASD-TDR-62-670)
forging, 17: 6589 (ASD-TDR-62-670)
mechanical properties, 17: 6517 (MAB-188-M)
sheet rolling of, 17: 6517 (MAB-188-M)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Al–Mo, phase studies, 17: 6729
Cr–Co–Mo–Ni, drilling of hardened Astroloy, 17: 6617
Cr–Cu–Fe–Mo–Ni–Ti, corrosion of, by reactor fuel dissolver solutions, 17: 6566 (HW-SA-2307)

Cr–Fe–Mo–Pu, mechanical properties of, 17: 6511(R) (BMI-1593(Del.))
Cu–Mo–Zr, analysis for boron by direct absorptiometric method, 17: 5965 (PG-Report-362)
Fe–Mo–Ni–W, coatings for, 17: 6563 (DC-61-7-6)
Ir–Mo, phase studies, 17: 6668(R) (NMI-9246)
Mo–Nb, properties of wrought, 17: 6672 (NP-12383)
Mo–Nb, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Mo–Nb–Ta, properties of wrought, 17: 6672 (NP-12383)
Mo–Nb–Ti, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Nb–W, extrusion, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W, melting, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W, workability, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W–Zr, fabrication and properties of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Os–W, phase studies, 17: 6668(R) (NMI-9246)
Mo–Ta, properties of wrought, 17: 6672 (NP-12383)
Mo–Th, phase diagrams, 17: 6659 (IS-442)
Mo–Ti, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Ti, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Mo–Ti, strength of, effects of boron additions on, 17: 6672 (NP-12383)
Mo–Ti–Zr, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Ti–Zr, phase studies, 17: 6668(R) (NMI-9246)
Mo–Ti–Zr, powder metallurgy, 17: 6668(R) (NMI-9246)
Mo–Ti–Zr, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Mo–U, analysis for impurities, visual, 17: 6528 (TID-7625(p.45-51))
Mo–U, annealing of quenched, reaction mechanisms in, 17: 6716
Mo–U, electron microscope studies of thin films of, 17: 6712
Mo–U, radiation effects, 17: 7563(R) (PRDC-TR-59)
Mo–U–V, properties and structure, 17: 6725
Mo–W, deoxidation, 17: 6672 (NP-12383)
Mo–W, extrusion, 17: 6589 (ASD-TDR-62-670)
Mo–W, forging, 17: 6589 (ASD-TDR-62-670)
Mo–W, mechanical properties of wrought, 17: 6672 (NP-12383)
Mo–W, melting, 17: 6672 (NP-12383)
Mo–Zr, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Mo–Zr, strength of, effects of boron additions on, 17: 6672 (NP-12383)

MOLYBDENUM ISOTOPES Mo-92
neutron reactions (n,p), cross sections for, 17: 7101 (NP-12330(p.97-103))

MOLYBDENUM ISOTOPES Mo-94
decay of 1.57-Mev state of, 17: 7257

MOLYBDENUM ISOTOPES Mo-95
neutron reactions (n,γ) in, gamma spectra from resonances in, 17: 6776(R) (ANL-6603(p.1-8))
neutron reactions (n,p), cross sections for, 17: 7101 (NP-12330(p.97-103))

MOLYBDENUM ISOTOPES Mo-96
neutron reactions (n,p), cross sections for, 17: 7101 (NP-12330(p.97-103))

MOLYBDENUM ISOTOPES Mo-99
production and use of, 17: 6171

MOLYBDENUM OXIDE FILMS
use for detection of energetic hydrogen ions, 17: 6409 (UCRL-6793)

MOLYBDENUM SILICIDES
$MoSi_2$–ZrB_2, oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12313)

MOLYBDENUM SULFIDES
development as solid lubricant, 17: 7606(R) (ORNL-1515)

MONAZITES
analysis for thorium, 17: 6021

MONKEYS
tissue cultures of leukocytes, 17: 5676 (SAM-TDR-62-99)

MONTE CARLO METHOD
use in gamma propagation near air-ground interface, 17: 6955 (RM-3399-PR)

MÖSSBAUER EFFECT
gamma resonance absorption by impurity nuclei in crystals, 17: 6854
in gold-197, solid-state and nuclear results from, 17: 7234
in iron at 4 to 1300°K, 17: 6778(R) (ANL-6603(p.20-46))
ultrasonic splitting of the absorption line in tin-119 oxide, 17: 6889

MULTIPLICATION FACTOR
statistical theory of neutron chain reactions, 17: 7059
statistical theory of neutron chain reactions, 17: 7060
statistical theory of neutron chain reactions, 17: 7061

MUTATIONS
radioinduced in *Chondrococcus columnaris*, 17: 5769 (HW-SA-2540)
radioinduced in mice, 17: 5673(R) (LAMS-2780(p.181-210))
radioinduced in tomatoes by gamma radiation, comparison with ethylenimine-induced, 17: 5892
radioinduced in yeast, 17: 5809
radioinduced, reaction mechanisms, 17: 5875

N

NAGASAKI
radiation effects on tumor incidence in populations, 17: 6333
statistical analysis of population for late radiation effects, 17: 6332
survey on incidence of mongolism in offspring of pregnant women exposed to radiation from atomic explosion, 17: 5848

NAPHTHALENE
spectra in gamma irradiated organic glasses at −196°C, 17: 6148

NATURAL WATERS (HUNGARY)
analysis for radium, radon, and uranium isotopes, 17: 6293

NAVAL REACTORS
development, 1962, 17: 5662

NECK
radiotherapy of, effects on ear, 17: 5896

NEODYMIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
photoelectron distribution from, cesium-137 gamma, 17: 6833
separation from lanthanum and yttrium, effects of solvent mixture on chromatographic, 17: 6009
separation from praseodymium and samarium by displacement chromatography, band distribution in, 17: 6004
separation from praseodymium by high temperature distillation of oxides, 17: 6070
separation from rare earths, 17: 6019
spectra of, effect of transitions in 4f shell on absorption, 17: 6099

NEODYMIUM CARBIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)

NEODYMIUM COMPLEXES
spectra of organophosphorus-trifluorothenoyl acetone, infrared, 17: 6050 (TID-15323)

NEODYMIUM ISOTOPES
alpha decay systematics for, 17: 7199

NEODYMIUM ISOTOPES Nd-147
beta spectra, 17: 7113 (NP-12330(p.166-71))

NEODYMIUM OXIDES
stabilization of, using metal oxides, 17: 6664 (MND-M-2346)

NEODYMIUM OXYTELLURIDES
preparation and properties, and crystalline structure, 17: 6068

NEON
neon ion collisions with, resonant electron capture and stripping in, 17: 6863

NEON IONS
collisions with neutral neon, resonant electron capture and stripping in, 17: 6863
reactions with copper, gold, and graphite at 100 to 30,000 ev, yields of secondary ions from, 17: 7268

NEON ISOTOPES Ne-20
deuteron reactions (d,n), distorted-wave Born approximation calculations on, 17: 7170
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
energy levels of first-rotational-band states of, 17: 7156
reactions with nickel at 130 Mev, 17: 7082 (JINR-P-1072)

NEON ISOTOPES Ne-22
deuteron reactions (d,n), distorted-wave Born approximation calculations on, 17: 7170
energy levels, 17: 6779(R) (ANL-6603(p.47-52))
range in aluminum at 1 to 3 Mev, 17: 7231

NEPTUNIUM

analysis, 17: 6025
NEPTUNIUM ISOTOPES Np-237
determination in human lungs, whole-body counting, 17: 5704 (TID-12790)
NERVOUS SYSTEM
radiation effects on function, 17: 5888
radiation effects from internal sources, effects of hypothermia, 17: 5889
radiation effects on, of eyes and skin in man, 17: 5851
radiation injuries after exposure of head, 17: 5887
response to radiation and trauma, 17: 5886
NEUROLOGY
research programs on, 17: 6801(R) (TID-17303)
NEUTRINOS
electrodynamics of, effects on cosmological models, 17: 7005
interactions and properties of standing, 17: 7016
interactions of, 17: 7037
interactions with nucleons, meson (π) production amplitudes for, 17: 7023
interactions with protons, cross sections for meson (K^+) production in, 17: 6953 (LNF-62/89)
NEUTRON ACTIVATION CROSS SECTIONS
determination of epithermal and fast, 17: 7306
determination of, in swimming pool reactor irradiations, 17: 7100 (NP-12330(p.95-6))
NEUTRON CROSS SECTIONS
measurements of, methods and problems in, 17: 7128 (NP-12330(p.369-77))
NEUTRON-DIFFRACTION ANALYSIS
equipment and methods development for, 17: 6809(T) (AEC-tr-5567)
instruments and methods for, review, 17: 7070
of ferroelectrics, 17: 6647 (BNL-5747)
NEUTRON DIFFRACTOMETERS
description of DIDO, 17: 6417
NEUTRON MONOCHROMATORS
structure of crystals for, 17: 6058(T) (AEC-tr-5566)
NEUTRON SHIELDING
computer program for, 17: 7496 (AEEW-M-261)
NEUTRON SOURCES
design and development of sealed-tube 14-Mev, using D-T and T-T reactions, 17: 7069
development of, for in-process radiotracer production, 17: 6511(R) (BMI-1583(Del.))
development of pulsed, for use in reactor startup, 17: 7541(R) (GEAP-4047)
gamma spectra from beryllium–polonium, 17: 7102 (NP-12330(p.104-8))
NEUTRON SPECTROMETERS
description of crystal, 17: 7070
design and performance of proton-recoil proportional, with gamma discrimination, 17: 6462
design of fast time-of-flight, for tandem accelerator, 17: 6465
NEUTRON TOTAL CROSS SECTIONS
measurement of, using directional detectors, 17: 7095 (NP-12330 (p.61-5))
NEUTRONS
absorption of low-energy, surface, 17: 7212
capture by samarium-150, spectra from, 17: 7273
chain reactions of, statistical theory of, 17: 7059
chain reactions of, statistical theory of, 17: 7060
chain reactions of, statistical theory of, 17: 7061
collision probabilities of, in spheres with arbitrary radial source distribution, 17: 7056 (HW-SA-2696)
coupling in transfer reactions, levels with different total angular momentum from, 17: 7155
detection and measurement of, description of instruments for, 17: 6447
detection and measurement, use of lutetium foils in, 17: 7549(R) (HW-74761(p.5.1-35))
detection and measurement, screening for accidental exposure using sodium-24 detector, 17: 5775 (TID-14529)
detection and measurement using thallium-activated sodium iodide, 17: 6474
detection and measurement using a proportional counter, energy dependence of, 17: 6477
detection and measurement of intermediate-energy, detector for, 17: 6478
detection and measurement of, mixed with neutrons using a dual ionization chamber system, 17: 6479
detection and measurement around nuclear installations, survey of methods for, 17: 6482
detection and measurement using a thermopile, 17: 6485
detector for, standardization of Radsan, 17: 6443 (USNRDL-TR-598)
diffraction in crystalline solids, 17: 7068
diffusion, computer program for transfer functions, 17: 7530 (AEEW-R-189)
diffusion equations, methods of multidimensional group computations of, 17: 7057 (TID-14262)
diffusion of, reactor transfer functions for, 17: 7531 (AEEW-R-197)
distribution in FRJ-1 Merlin Reactor, 17: 7634 (JUL-75-RE)
dosimetry, in the presence of gamma radiation, 17: 5774 (TID-13984)
dosimetry of, development and evaluation of instruments and methods for, 17: 6437 (JUL-69-ST)
dosimetry of pulsed and steady-state, 17: 5780 (USNRDL-TR-583)
flux distributions in cylinders, 17: 7062
flux measurements in zero-energy reactors, instruments for, 17: 6483
flux of, and experimental measurement theory, 17: 7063
flux scanning in reactors, 17: 6489(P)
flux variation analysis, method for, 17: 7638
interactions with protons at 0.4926 and 3.205 Mev, precision measurements of the total cross section of, 17: 6976
interactions with deuterons, scattering lengths for, 17: 7089 (NP-12330 (p.15-16))
lifetimes in beryllium-oxide-moderated slightly enriched uranium oxide cores, 17: 7535 (CEA-2201)
production in d-t and d-p interactions, 17: 7241
reactions (n,γ) with gadolinium-155 and 157, gamma and electron conversion spectra from, 17: 7175
reactions (n,γ) with molybdenum-95, gamma spectra from resonances in, 17: 6776(R) (ANL-6603(p.1-8))
reactions (n,p) on beryllium-9, cross sections for, 17: 7198
reactions on nuclei, cross sections for epithermal, 17: 7306
reactions with indium at 14 Mev, alpha spectra from, 17: 7207
resonance integrals of, calculation of effective, 17: 7054 (AEEW-R-118)
rethermalization of, in graphite and water, 17: 7055 (HW-SA-2415)
scattering by beta brass, cross sections for, 17: 6705
scattering by deuterium at 0.5 to 1.95 Mev, differential cross section and polarization of, 17: 6777(R) (ANL-6603(p.9-19))
scattering by lead isotopes, energy level excitations in inelastic, 17: 7099 (NP-12330(p.86-94))
scattering by nuclei, search for selectively excited spin-zero states in even-even nuclei by, 17: 7075 (AROD-2577:2)
scattering by oxygen-16, cross sections for, 17: 7174
scattering by the Coulomb field of nuclei, theory of, 17: 7074
scattering in paramagnetic materials, effect of spin-spin interaction on, 17: 7072(T)
NEVADA PROVING GROUNDS AREA
plant ecology, effects of atomic explosions, 17: 5655 (HW-SA-2546)
NEW HAMPSHIRE
thorium content of Conway granite in, 17: 6297
NEW YORK
nuclear port survey, 17: 6312 (NP-12238)
NEW ZEALAND
fallout monitoring in, 17: 5750(R) (DXRL-F6)
fallout, radioisotope levels in, 17: 5751(R) (HASL-132)
radiation monitoring of rain water in, 17: 5758
NI-O-NEL
corrosion by nitric acid, 17: 6192(T,R) (EURAEC-382)
NICHROME
cladding on reactor fuel elements, high-temperature properties of, 17: 7571 (TID-17402)
NICKEL
corrosion by nitric acid, 17: 6192(T,R) (EURAEC-382)
corrosion by sodium hydroxides, 17: 7606(R) (ORNL-1515)
corrosion of, by liquid lithium fluoride–sodium fluoride–zirconium tetrafluoride, 17: 6571 (ORNL-TM-411)
determination in nickel steel and electro-etch residues, activation, 17: 5984
dissociation energy of gaseous and heat of vaporization of solid,

correlation of, 17: 6095
heat of sublimation and vaporization of solid, 17: 6093
ion ranges in, determination from collection experiments, 17: 6820
mesic atom (μ^-) decay in, anomaly in, 17: 6888
neon-20 reactions with, at 130 Mev, 17: 7082 (JINR-P-1072)
neutron form factors and spin density distributions for, comparison with Hartree-Fock calculations, 17: 6646 (BNL-5674)
neutron resonance cross sections, 17: 7595(R) (ACNP-62018)
photoelectric properties, 17: 6801(R) (TID-17303)
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
separation from cobalt and copper by ion exchange, 17: 6180 (IA-769)
temperature effects on mechanical properties of, cryogenic, 17: 6542
thermal conductivity of radiator fins of, 17: 6673 (ORNL-2065)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))

NICKEL ALLOYS
corrosion by fused-salt fuels, 17: 7565(R) (PWAC-161)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
corrosion of, by liquid lithium fluoride–sodium fluoride–zirconium tetrafluoride, 17: 6571 (ORNL-TM-411)
corrosion of, in high-temperature water cooled reactors, 17: 6567 (HW-SA-2745)
creep buckling data, 17: 7565(R) (PWAC-161)
drilling, 17: 6615
end milling of U-500, 17: 6614
high-strength, bibliography on, 17: 6521 (NP-12417)
thermal conductivity, 17: 6673 (ORNL-2065)
thermal cycling tests, 17: 7565(R) (PWAC-161)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Al–Fe–Ni, corrosion of, by water above 315°C, 17: 7552(R) (HW-74761 (p.8.1-15))
Be–Ni, corrosion by water at 343°C, 17: 6568(R) (NMI-1905)
Co–Ni, plastic deformation of single crystals of, 17: 6695(T) (AEC-tr-5568)
Cr–Co–Mo–Ni, drilling of hardened Astrolov, 17: 6617
Cr–Co–Ni–W, machining characteristics of HS-25, 17: 6609
Cr–Co–Ni–W, machining of HS-25, 17: 6611
Cr–Cu–Fe–Mo–Ni–Ti, corrosion of, by reactor fuel dissolver solutions, 17: 6566 (HW-SA-2307)
Cr–Fe–Ni, corrosion by fused fluorides, 17: 7606(R) (ORNL-1515)
Cr–Fe–Ni, corrosion by carbon dioxide, 17: 6560 (AAEC/E-98)
Cr–Ni–Zr, corrosion of, oxygen gradients in, 17: 6579
Cu–Mn–Ni, corrosion by nitric acid, 17: 6192(T,R) (EURAEC-382)
Fe–Mo–Ni–W, coatings for, 17: 6563 (DC-61-7-6)
Ni–Nb–V, oxidation, 17: 6562(R) (ARF-B-6001-1)
Ni–Pd, polarization of protons in, 17: 6945 (BNL-5648)
Ni–Ti, diffusion of, in C–Ni system, 17: 6591 (ASD-TDR-62-734)
Ni–Ti, diffusion of, in B–Ni system, 17: 6591 (ASD-TDR-62-734)
Ni–Zr, extrusion of, effects on structure, 17: 6654(R) (EURAEC-394)

NICKEL COATINGS
bonding to aluminum and uranium, 17: 6606

NICKEL(II) COMPLEXES
spectra of, assignment of ligand-field, 17: 6115 (NYO-9868)
with oximes, solubility and stability of, 17: 6114 (IS-434)

NICKEL ISOTOPES Ni-58
deuteron reactions (d,p) at 13.8 Mev, proton polarization from, 17: 7286
deuteron reactions (d,t) at 21.6 Mev, 17: 6780(R) (ANL-6603(p.52-5))
neutron reactions (n,p) on, yields from epithermal and fast, 17: 7306
proton inelastic scattering at 6.6 Mev, 17: 7178
proton reactions at 57 Mev on, proton distributions from, 17: 7197

NICKEL ISOTOPES Ni-60
deuteron reactions (d,p) at 13.8 Mev, proton polarization from, 17: 7286
proton inelastic scattering at 6.6 Mev, 17: 7178

NICKEL OXIDE FILMS
preparation of thin, for use as isotopic oxygen targets, 17: 5945

NICKEL OXIDES
emittance at high temperatures, total hemispherical, 17: 6731
Cr_2O_3–NiO–SiO_2, endurance of aluminum phosphate-bonded coating of, 17: 6675(R) (PWA-2128)

NICKEL POWDERS
neutron diffraction by, thermal, 17: 7070

NICKEL STEEL
analysis of, activation, 17: 5984

NICKEL SYSTEMS
B–Ni, diffusion of, in Ni–Ti alloys, 17: 6591 (ASD-TDR-62-734)
C–Ni, diffusion of, in Ni–Ti alloys, 17: 6591 (ASD-TDR-62-734)
Ni–TiB_2, preparation, 17: 6591 (ASD-TDR-62-734)
Ni–TiC, preparation, 17: 6591 (ASD-TDR-62-734)

NIOBIUM
analysis, 17: 6022
bibliography on, 17: 6521 (NP-12417)
brazing of, 17: 6558
corrosion by fused-salt fuels, 17: 7565(R) (PWAC-161)
corrosion by lead (liquid) at high temperatures, 17: 7606(R) (ORNL-1515)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
determination, 17: 6022
determination in iron alloys, x-ray spectrochemical, 17: 5997
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
effects of additions of, on extrusion and forging of tungsten alloys, 17: 6589 (ASD-TDR-62-670)
effects on corrosion of antimony–zirconium alloys by water at 680°F, 17: 6561(R) (ARF-2198-34)
effects on corrosion of ion–zirconium alloys by steam at 750°F, 17: 6561(R) (ARF-2198-34)
fabrication of irradiation, specimens, 17: 6558
helium nucleus reactions at 240 to 880 Mev, 17: 7149 (UCRL-10461)
mechanical properties at 1600 and 1800°F, 17: 7606(R) (ORNL-1515)
oxidation, 17: 7606(R) (ORNL-1515)
proton reactions at 240 to 880 Mev, 17: 7149 (UCRL-10461)
separation from tantalum and zirconium by solvent extraction, 17: 6022
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
welding, 17: 6631

NIOBIUM ALLOYS
mechanical properties, 17: 6517 (MAB-188-M)
oxidation, 17: 6564(R) (DRI-2056)
protective coatings for, 17: 6510 (ASD-TDR-62-934)
sheet fabrication, 17: 6593(R) (ASD-TR-7-784(VII))
sheet rolling of, 17: 6517 (MAB-188-M)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Al–Nb–Ti, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)
Al–Nb–Zr, phase studies, 17: 6729
Al–Nb–Zr, preparation, 17: 6652(R) (DRI-2057)
Be–Nb, oxidation, 17: 6653(R) (DRI-2071)
Be–Nb, oxidation, 17: 6643(R) (BBC-112)
Ga–Nb–Zr, phase studies, 17: 6729
Hf–Nb, phase strengthening, 17: 6555
Hf–Nb, phase studies, 17: 6668(R) (NMI-9246)
Ir–Nb, phase studies, 17: 6668(R) (NMI-9246)
Mo–Nb, properties of wrought, 17: 6672 (NP-12383)
Mo–Nb, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Mo–Nb–Ta, properties of wrought, 17: 6672 (NP-12383)
Mo–Nb–Ti, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Nb–W, extrusion, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W, melting, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W, workability, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W–Zr, fabrication and properties of rolled sheet, 17: 6597(R) (DMIC-176)
Nb–Rh, phase studies, 17: 6668(R) (NMI-9246)
Nb–Ru, phase studies, 17: 6668(R) (NMI-9246)
Nb–Sn, intermediate phases in, 17: 6703
Nb–Sn, superconductivity in, 17: 6807 (UCRL-9819)
Nb–Sn–Zr, corrosion in water and steam, 17: 6535(T) (EURAEC-352)
Nb–Sn–Zr, corrosion by steam and water, 17: 6581
Nb–Sn–Zr, fabrication of tubing of, 17: 6600(T) (EURAEC-354)
Nb–Sn–Zr, mechanical properties of, hydrogen effects on, 17: 6696(T) (EURAEC-353)
Nb–Sn–Zr, phase studies, 17: 6697(T) (EURAEC-358)
Nb–Sn–Zr, welding, 17: 6535(T) (EURAEC-352)
Nb–Ta–V, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Nb–Ti–V, protective coatings for, 17: 6562(R) (ARF-B-6001-1)
Nb–U, analysis for impurities, visual, 17: 6528 (TID-7625(p.45-51))
Nb–Zn, superconductivity of, critical persistent currents in, 17: 6875
Nb–Zn, superconductivity of, critical persistent currents in, 17: 6875

Nb–Zr, corrosion by steam and water, 17: 6581
Nb–Zr, current-carrying capacity in superconducting solenoids, 17: 6209
Nb–Zr, emissivity, 17: 6675(R) (PWA-2128)
Nb–Zr, mechanical properties of, hydrogen effects on, 17: 6696(T) (EURAEC-353)
Nb–Zr, phase strengthening in, 17: 6555
Nb–Zr, radiation effects on superconducting, proton, 17: 6756
Nb–Zr, superconductivity in, 17: 6807 (UCRL-9819)
Nb–Zr, welding of, 17: 6558
Ni–Nb–V, oxidation of coatings of, 17: 6562(R) (ARF-B-6001-1)

NIOBIUM BORIDES
compact preparation, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)

NIOBIUM CARBIDES
compact preparation, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
reflection spectra, 17: 6520(R) (NP-12373)
thermal expansion, 17: 6520(R) (NP-12373)
NbC–NbN, reflection spectra of, 17: 6520(R) (NP-12373)
NbC–ZrC, Hall effect, 17: 6520(R) (NP-12373)
NbC–ZrC, reflection spectra of, 17: 6520(R) (NP-12373)

NIOBIUM ISOTOPES Nb-90
decay of isomers of, 17: 7294
half life of the isomeric state of, 17: 7294

NIOBIUM ISOTOPES Nb-92
production in molybdenum-92 (n,p) reactions, cross sections for, 17: 7101 (NP-12330(p.97-103))

NIOBIUM ISOTOPES Nb-94
energy levels, 17: 7257

NIOBIUM ISOTOPES Nb-95
determination in human lungs, whole-body counting, 17: 5704 (TID-12790)
production in molybdenum-95 (n,p) reactions, cross sections for, 17: 7101 (NP-12330(p.97-103))

NIOBIUM ISOTOPES Nb-96
production in molybdenum-96 (n,p) reactions, cross sections for, 17: 7101 (NP-12330(p.97-103))

NIOBIUM NITRIDES
Hall effect, 17: 6520(R) (NP-12373)
NbC–NbN, reflection spectra of, 17: 6520(R) (NP-12373)

NIOBIUM POWDERS
superconductivity of, critical persistent currents in, 17: 6875

NIOBIUM SYSTEMS
C–Nb, metallography, 17: 6525 (TID-7625(p.8-19))
Nb–O, metallography, 17: 6525 (TID-7625(p.8-19))

NITRATE IONS
determination in water, colorimetric, 17: 5977 (TID-15070)

NITRIC ACID
corrosive effects on Coronel, Inconel, nickel, and Ni–O–Nel, 17: 6192(T,R) (EURAEC-382)
electrophoretic effects on bismuth-210, lead-210, and polonium-210, 17: 6153
solvent properties for plutonyl nitrates, 17: 6191(T) (CEA-tr-R-1514)

NITRITE IONS
determination in water, colorimetric, 17: 5977 (TID-15070)

NITROGEN
determination by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
determination in molybdenum, niobium, and tungsten by vacuum extraction, 17: 6022
diffusion in zirconium, relation to internal friction, 17: 6724
electron drift velocities in, 17: 7018
ionization of molecular, during collisions with molecular oxygen, 17: 6864
metabolism in yeasts, radiation effects, 17: 5881
oxidation of magnesium by, 17: 6577
radioinduced reactions with carbon dioxide and oxygen by fission products, 17: 6161
reactions with cerium, 17: 6100

NITROGEN ISOTOPES N-12
decay of, comparison of beta spectra with boron-12, 17: 7141 (TID-15182)

NITROGEN ISOTOPES N-13
gamma spectra of, to first-excited and ground states, 17: 7153

NITROGEN ISOTOPES N-14
deuteron reactions (d,p), angular distribution and excitation curves for, 17: 7159
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
proton reactions (p,np), cross sections for, 17: 7188

NITROGEN ISOTOPES N-15
energy level de-excitation in, formed in nitrogen-15 (d,p) reactions, 17: 7159

NONANE
determination in kerosene by vapor-phase chromatography, 17: 6195

NOZZLES
stress in pressure vessel, 17: 6246 (NYO-10147)

NRU REACTOR
shutdown of, extension of time-to-poison in, 17: 7536 (CRIO-1115)

NUCLEAR AIRCRAFT POWER PLANTS
design and development, 17: 7606(R) (ORNL-1515)

NUCLEAR BATTERIES
application to space propulsion systems, 17: 6543
developments for space applications, 17: 6551

NUCLEAR EMULSIONS
proton reactions at 9 Bev in, angle and energy measurements of, 17: 6971
scanning of, automatic, 17: 6476
use as fast neutron dosimeter, 17: 6323 (UCRL-9967)
use for determination of radium and uranium in solutions, 17: 6003

NUCLEAR ENGINEERING
training in, in Western Europe, 17: 5661

NUCLEAR MAGNETIC MOMENTS
measurement of dynamic nuclear polarization, 17: 7164

NUCLEAR MAGNETIC RESONANCE
magnetic field inhomogeneities, correction for high-resolution spectroscopy, 17: 6418
measurement of, using low-field spectrometers, 17: 7126 (NP-12330 (p.259-76))
research programs on, 17: 6801(R) (TID-17303)
spectrometer, use of modulation in high-resolution, 17: 6421
theory of high-resolution, in presence of weak radio-frequency field, 17: 6076

NUCLEAR MODELS
analysis of alpha, 17: 7189
energy spectrum of center of gravity, in second order, 17: 7508
intrinsic symmetries of rotational states, 17: 7206
nucleon interactions with nucleon clusters in nuclei, high energy, 17: 7209
relation between the shell model and the rotation-vibration model, 17: 7220
relation between the shell model and the rotation-vibration model, 17: 7221
statistical, with account of correlations, 17: 7284

NUCLEAR MODELS (COLLECTIVE)
scattering, cross sections for inelastic diffraction, 17: 7205

NUCLEAR MODELS (OPTICAL)
average resonance parameters in, 17: 7244
neutron surface absorption by, low-energy, 17: 7212

NUCLEAR MODELS (SHELL)
comparisons with alpha-model, 17: 7189
hole-particle interactions in, 17: 7192
photonuclear reactions in, spin-orbit effects on, 17: 7167

NUCLEAR PHYSICS
analysis of intermediate coupling, 17: 7140 (TID-14921)
book: *Electronic Equipment in Nuclear Physics*, 17: 6426
gauge invariance and correlated boson fields, 17: 6969
measurement of lifetimes of excited nuclear states using delayed gammas, 17: 6958 (UCRL-7091)
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
research on, in Germany, 17: 5698
symposium, 17: 7087 (NP-12330)

training in, in Western Europe, 17: 5661
volume effects in, 17: 7103 (NP-12330(p.109-18))
NUCLEAR POWER
development in Britain, 17: 5664
developments, 1962, 17: 5662
NUCLEAR POWER PLANTS
description of 525-Mw(e) sodium-graphite, 17: 7623
design and construction, 17: 7617
design of, optimalization of parameters in, 17: 7619
development program for superheating, 17: 7624
development, 1962, 17: 5662
parameters of dynamic behavior of, 17: 7529 (AEEW-R-179)
NUCLEAR REACTIONS
average resonance parameters and the optical model, 17: 7244
deuteron stripping, with light and medium nuclei, polarization of protons from, 17: 7286
direct interaction processes in, 17: 7094 (NP-12330(p.46-52))
direct interactions in low-energy, 17: 7091(NP-12330(p.22-34))
distributions from (γ,n) and (γ,p) spin-orbit effects on, 17: 7167
energy levels from quasi-elastic, alpha model evaluation of, 17: 7189
Feynman amplitudes for nonrelativistic processes, 17: 7524
formation of deuterons from proton bombardment of nuclei at 25 to 30 Bev, 17: 7258
jet distributions from 10^{13}-ev cosmic-particle, 17: 6919
mechanisms of, calculation by one-dimensional theory of showers, 17: 7183
neutron coupling in transfer, 17: 7155
pair correlations in two-gamma processes, 17: 7190
photo-, giant dipole resonances in, 17: 7305
splitting of E1 giant resonance into two peaks, 17: 7253
stripping, applications of pology to, 17: 7255
structure in direct theory, at 10^3 to 10^4 Mev, 17: 7186
threshold effects in average cross sections according to R-matrix theory, 17: 7236
NUCLEAR SPIN
interactions with ultrasounds, 17: 6792(R) (ISS 62/14)
nuclear relaxation as a probe of electron spin correlation, 17: 6856
NUCLEAR STRUCTURE
analysis of intermediate coupling, 17: 7140 (TID-14921)
application of theory of a Fermi fluid consisting of two types of particles to the nucleus, 17: 7303
investigation by meson (K^-) capture, 17: 7232
method for studying the optical anisotropy and shape of the surface of nuclei, 17: 7302
reference spectrum method for nuclear matter, 17: 7214
relation between the shell model and the rotation-vibration model, 17: 7220
relation between the shell model and the rotation-vibration model, 17: 7221
theory of, from high-energy particle reactions, 17: 7186
three-nucleon clusters in nuclear matter, 17: 7215
volume effects on, 17: 7103 (NP-12330(p.109-18))
NUCLEAR THEORY
application of theory of a Fermi fluid consisting of two types of particles to the nucleus, 17: 7303
Asymptotic behavior of the Vertex part in pseudoscalar meson theory, 17: 7505
average resonance parameters and the optical model, 17: 7244
equilibrium figures and fission of a rotating nucleus, 17: 7298
many-body problem in, with nonuniform density, 17: 7260
method for studying the optical anisotropy and shape of the surface of nuclei, 17: 7302
moments of inertia of a heated nucleus and angular anisotropy of the fission fragments, 17: 7301
of neutron scattering by the Coulomb field of the nucleus, 17: 7074
reference spectrum method for nuclear matter, 17: 7214
relation between the shell model and the rotation-vibration model, 17: 7220
relation between the shell model and the rotation-vibration model, 17: 7221
splitting of E1 giant resonance into two peaks, 17: 7253
statistical nuclear model with correlations accounted for, 17: 7284
three-nucleon clusters in nuclear matter, 17: 7215
threshold effects in average cross sections according to R-matrix theory, 17: 7236
NUCLEI
alpha decay systematics for medium-heavy beta-stable, 17: 7199
collective vibrations of even-even, with A ≈30, 17: 7104 (NP-12330 (p.119-21))
concentration measurement apparatus for condensation, in gases, 17: 6488(P)
concentration measurement of airborne condensation, apparatus for, 17: 6490(P)
cosmic particle reactions on, jet distributions from 10^{13}-ev, 17: 6919
Coulomb energies of light, 17: 7090 (NP-12330(p.17-21))
decay of neutron-deficient, emission of delayed protons in positron, 17: 7169
electron elastic scattering by, theory of relativistic Coulomb, 17: 7520
electron elastic scattering by, Green's function and optical potential analysis of, 17: 7187
electron scattering by, cross sections for EO transitions in, 17: 7269
energy level configurations in, doublets from, 17: 7105 (NP-12330 (p.122-5))
energy level displacement in K = 0 band of odd-odd deformed, effects of scattering on, 17: 7146 (UCRL-9764)
energy level excitation and measurement using resonant scattering of gamma radiation of variable energy, 17: 7229
energy levels of closed-shell, 17: 7088 (NP-12330(p.1-14))
energy levels of, hole-particle interactions in collective, 17: 7192
equilibrium figures and fission of rotating, 17: 7298
excitations in scattering fast particles, collective, 17: 7184
excited states of, measurements using pulsed beam accelerator and coincidence methods, 17: 6450
gamma emission by, effect of pair correlations in two-gamma, 17: 7190
gamma reactions (γ,π), cross sections for, 17: 6975
gamma reactions (γ,n) and (γ,p) on, spin-orbit effects in, 17: 7167
gamma reactions on, electron pair production in, 17: 7304
gamma reactions on, giant dipole resonances in, 17: 7305
interactions of high energy nucleons with, 17: 7209
intrinsic symmetries of rotational states, 17: 7206
meson (K^-) capture by, for nuclear structure measurement, 17: 7232
meson (π^-) capture in complex, 17: 6792(R) (ISS 62/14)
moments of inertia of heated, 17: 7301
neutron scattering by even-even, search for selectively excited spin-zero states by, 17: 7075 (AROD-2577:2)
neutron surface absorption by, low-energy, 17: 7212
nucleon reactions with light, optical potential calculation for, 17: 7188
nucleon scattering amplitudes for, 17: 7080 (JINR-P-1024)
optical anisotropy and shape of the surface of, method for studying, 17: 7302
optical potential of, calculation of imaginary part of, 17: 7143 (TID-17357(Pt.II))
particle elastic scattering by, variational calculations for, 17: 7507
particle scattering by, cross sections for elastic, 17: 7205
polarizability of, 17: 7025
polarization of magnetic, 17: 7267(T)
polarization of, measurement of dynamic, 17: 7126 (NP-12330(p.259-76))
polarization of, measurement of dynamic, 17: 7164
polarization of, using magnetic resonance, 17: 7123 (NP-12330(p.224-41))
positron scattering by, cross sections for EO transitions in, 17: 7269
properties of finite, theory of, 17: 7249
properties of, volume effects on, 17: 7103 (NP-12330(p.109-18))
proton emission by decaying, 17: 7082 (JINR-P-1072)
proton reactions at 9 Bev with, angle and energy measurements of, 17: 6971
reaction matrix theory for, 17: 7211
rotational levels of even-even, intrinsic excitation of, 17: 6956 (TID-13705)
spectra of heavy primary cosmic, 17: 6931
transition probabilities for, effects of dipole polarization on, 17: 7191
transitions in deformed even, branching ratio of E2, 17: 7208
NUCLEONS
coupling to spherical core, energy spectrum, 17: 7508

energy levels in closed-shell nuclei, 17: 7088 (NP-12330(p.1-14))
interacting systems of, singularity of t-matrix of, 17: 7006
interactions and properties of, model for, 17: 7016
interactions at high energies, azimuthal angular distribution of secondary particles from, 17: 7019
interactions of, amplitudes in, 17: 7080 (JINR-P-1024)
interactions with nucleons at high energies, semi-phenomenological model for meson (π) production in, 17: 6984
interactions with mesons (π), spin rotation effects in, 17: 6985
interactions with mesons (π), dispersion relations in, 17: 7010
interactions with neutrinos, meson (π) production amplitudes for, 17: 7023
interactions with mesons (π), effect of π-π interactions on s and p waves of, 17: 7024
interactions with nucleons at 40, 95, 147, and 310 kev, phase-shift analysis of, 17: 7027
interactions with mesons (π), interaction constant for, 17: 7027
interactions with mesons through large angles, Regge fermion poles in, 17: 7034
interactions with nucleons, inelastic, 17: 7040
interactions with mesons (π), gauge groups and symmetries of the isospace associated with nonrelativistic rotator, 17: 6970
interactions with nucleons at 9 Bev, angle and energy measurements of, 17: 6971
interactions with nucleons in nuclear matter, intermediate coupling in, 17: 7140 (TID-14921)
interactions with light nuclei at high energy, 17: 7209
mesic form factor of, 17: 7505
polarizability of, 17: 7025
potential in nuclei, reaction matrix theory for, 17: 7211
production by proton reactions with aluminum, beryllium, and iron at 30 Bev, 17: 7259
reactions with light nuclei, optical potential calculation for, 17: 7188
reactions with nuclear collective excitation, 17: 7193
scattering by nuclei, amplitudes in, 17: 7080 (JINR-P-1024)
transitions in nuclei, nuclear core dipole excitation effects on, 17: 7191

NUCLEOTIDES
radiation effects, 17: 5877
radiation effects on metabolism in liver, whole-body exposure, 17: 5879
radiation effects on metabolism in liver, tracer study, 17: 5879

NUCLEOTIDES, PYRIDINE DIPHOSPHATE
protective effects against radiation injury in chick embryos, 17: 5914

O

OAK RIDGE NATIONAL LAB., TENN.
monitoring of site and environs, 1961, 17: 6316(R) (ORNL-3284)

OCTANE
determination in kerosene by vapor-phase chromatography, 17: 6195

OILS
analysis for oxygen, activation, 17: 5993
radioinduced thermal decomposition of paraffin, limiting temperature in, 17: 6159

OLIVE OIL
analysis of residual water of, for uranium, 17: 6284
protective effects against lethal dosages of whole-body radiation, 17: 5859

ORGANIC COMPOUNDS
analysis for hydrogen by thermal neutron scattering, 17: 5949 (BNL-5814)
radioinduced formation in aqueous solutions of carbon dioxide, 17: 6168
synthesis using fission fragments, 17: 6176(P)

ORGANIC COOLED REACTORS
coolant fouling test for, 17: 7561 (NAA-SR-7362)
description of 30-Mw(t) Italian, 17: 7618

ORGANIC MODERATED REACTORS
description of 30-Mw(t) Italian, 17: 7618

ORGANS
radiation effects on female genital, in mice, 17: 5795
transplantation in irradiated mice and men, 17: 5683

ORNL RELATIVISTIC ISOCHRONOUS CYCLOTRON
beam phase measurements, 17: 7410
design features of, 17: 7357
magnet regulators for, 17: 7376
magnetic field computations for, 17: 7385
magnetic field measurements, 17: 7375

OROTIC ACID
radiation chemistry, 17: 5877

OSCILLOGRAPHS
for strain gages, 17: 6405 (SCTM-364-61(73))
pulse coding in photographs of traces, 17: 6469
use of sampling, for observing photomultiplier pulses, 17: 6468

OSMIUM
determination in ruthenium using diantipyrinylpropylmethane, photometric, 17: 6014
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095

OSMIUM ALLOYS
Ir–Os, superconductivity of solid solutions of, 17: 6860
Mo–Os–W, phase studies, 17: 6668(R) (NMI-9246)

OSMIUM CHLORIDES
vapor pressure, 17: 6036(R) (GA-1536)

OSMIUM ISOTOPES Os-188
energy level at 155 kev, gyromagnetic ratio of, 17: 7225

OSMIUM ISOTOPES Os-189
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))

OSMOSIS
pressures of, measurement of, 17: 6420

OTTAWA RIVER
monitoring for beta activity at Chalk River, program for, 17: 6334

OXALACETIC ACID
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)

OXALIC ACID
analytical use of carbon-14 labeled, for determination of alkaline earth metals, 17: 5992

OXETANES
radioinduced polymerization of 3-3 bis-chloromethyl oxabutane, 17: 6155

OXIME COMPLEXES
properties, structure, and uses of *vic*-dioximes, 17: 5954 (IS-431)
with nickel(II), solubility and stability of, 17: 6114 (IS-434)

OXYGEN
atomic energy levels, intensity of forbidden emission lines, 17: 6903
determination by micro-platinum bath vacuum fusion method, 17: 5967 (PG-Report-381)
determination in molybdenum, niobium, and tungsten by vacuum extraction, 17: 6022
determination in petroleum products, activation, 17: 5993
diffusion in polycrystalline beryllium oxide, 17: 6666 (NAA-SR-7637)
effect on radiosensitivity of chromosomes, 17: 5833
effects on radiosensitivity of *Escherichia coli*, 17: 5878
etching effects on graphite at 700 to 870°C, 17: 6722
ionization of molecular, during collisions with molecular nitrogen and oxygen, 17: 6864
metabolism in *Staphylococcus aureus* and its radioinduced mutant, effects of substrates on, 17: 5790(T)
neutron polarization in liquid, measurement of, 17: 7064
oxidation of magnesium by, 17: 6577
proton elastic scattering at 8.66 to 19.2 Mev, optical model analysis of, 17: 7235
radioinduced reactions with nitrogen by fission products, 17: 6161
reactions with acetyl and methyl radicals, 17: 6071
removal from boilers, 17: 6225(P)
thermodynamic properties of, in Hf, Ti, and Zr systems, 17: 6111

OXYGEN ISOTOPES O-16
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
energy levels in, α model of, 17: 7189
gamma reactions (γ,dn) and (γ,dp), 17: 7295
neutron differential effective cross sections near Mev, 17: 7174
nucleon levels in, 17: 7088 (NP-12330(p.1-14))
optical potential of, calculation of imaginary part of, 17: 7143 (TID-17357(Pt.II))
photospallation of, hyperfine structure of dipole resonance in, 17: 7193

proton differential scattering cross sections, 17: 7228
proton reactions (p,np), cross sections for, 17: 7188
proton reactions (p,d) at 17.6 to 20 Mev, 17: 7217
reaction matrix theory for, 17: 7211
OXYGEN ISOTOPES O-17
determination in heavy water, 17: 5956 (KR-30)
gamma reactions (γ,d), mechanisms in, 17: 7185
proton Coulomb energies in light nuclei, 17: 7090 (NP-12330(p.17-21))
OXYGEN ISOTOPES O-18
alpha reactions (α,n), resonances in, 17: 6779(R) (ANL-6603(p.47-52))
determination in heavy water, 17: 5956 (KR-30)
deuteron reactions (d,n) at 3.9 Mev, differential cross sections for, 17: 7239
proton reactions (p,d) and (p,t) at 17.6 to 20 Mev, 17: 7217
OXYGEN SYSTEMS
Hf–O, thermodynamic properties of, 17: 6111
Nb–O, metallography, 17: 6525 (TID-7625(p.8-19))
O–Si–Ti–W–Zr, oxidation resistance of, testing as tungsten coating, 17: 6519(R) (NP-12293)
O–Ti, thermodynamic properties of, 17: 6111
O–U, thermodynamics between $UO_{2.x}$ and UO_{x}, 17: 6106
O–Zr, thermodynamic properties of, 17: 6111

P

PACKED COLUMNS
heat transfer in, equations for transient, 17: 6234
PAIR PRODUCTION
cross sections for, αZ correction for Bethe-Maximon, 17: 6948 (IS-429)
electron, by low-energy photons on nuclei, 17: 7304
PALLADIUM
absorption of hydrogen by, effects on alpha–beta transitions and electric conductivity, 17: 6690 (WAPD-T-1268)
alloying effects on zirconium alloy corrosion, 17: 6581
catalytic effects on hydrogen reactions, 17: 6098
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
heat of sublimation and vaporization of solid, 17: 6093
neutron total cross sections for, thermal, 17: 7128 (NP-12330(p.369-77))
separation of, radiochemical procedure for, 17: 6132(R) (TID-17272)
PALLADIUM ALLOYS
Ni–Pd, polarization of protons in, 17: 6945 (BNL-5648)
Pd–W, powder metallurgy, 17: 6668(R) (NMI-9246)
PALLADIUM CHLORIDES
spectra of gaseous, infrared, 17: 6036(R) (GA-1536)
PALLADIUM ISOTOPES Pd-110
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))
PAPER
transfer of carbon from impregnated, 17: 6223
PARAFFIN
neutron shielding efficiency of, measurement, 17: 7067
PARAMAGNETIC MATERIALS
energy gap effects on superconductors, 17: 6878
magnetic susceptibility measurement in dilute solutions, 17: 6884
neutron scattering by spin system of, thermal, 17: 7073(T)
PARAMECIUM
radiation effects on rate of vegetative fission, 17: 5778 (TID-15521)
PARTICLE PRECIPITATORS
development of, for submicron particles in aerosols, 17: 6304(R) (ARF-3187-10)
PARTICLE STATISTICS
quantum mechanical, of a many-body system with several components, 17: 7511
PARTICLE TRACKS
analysis of, using sodium chloride crystals, 17: 7261
PARTICLES
collision cross sections of spinless, theory, 17: 6774 (AFCRL-531(I))
fall velocity of fallout, measurement, 17: 6303 (AD-276121)
PEACH BOTTOM POWER REACTOR
development of, review, 17: 7598 (GA-2566)
2,4-PENTANEDIONE
radiation chemistry of, in rhodium complexes, 17: 7133 (NP-12330 (p.407-14))
radiation damage in, kinetics of thermal annealing of, 17: 7134 (NP-12330(p.415-21))
PENTANES
radiolysis, radical yields from, 17: 6144
PERCHLORATES
reactions with chromium(III)–neptunium(V) complex in perchloric acid, spectra of, 17: 6074
PERCHLORIC ACID
electrophoretic effects on bismuth-210, lead-210, and polonium-210, 17: 6153
PERMEABILITY
in heterogeneous media, computational scheme for, 17: 6790 (HW-SA-2405)
PEROXIDASES
activity in granulocytes after irradiation and in leukemias, 17: 5811
PERSONNEL
protective measures for, in radioisotope prospecting, 17: 6342
radiation dose for, using radioisotopes in industry and research, 17: 6320 (TID-16553)
radiation effects on, cosmic, 17: 6305 (BNL-6501)
radiation hazards to medical, survey, 17: 6361
PERTURBATION THEORY
energy spectrum of center of gravity theorem in second order, 17: 7508
formalism of, using continued fractions, 17: 6508
integral representations in, 17: 7515
scattering amplitudes in, parametric representations of, 17: 6965
use of a reduced set of states in, 17: 7509
PETROLEUM
industrial applications of radioisotopes in, 17: 6369
PHANTOMS
design of tissue equivalent dog, 17: 5780 (USNRDL-TR-583)
iodine-131 uptake by thyroid gland in, 17: 5743
neutron dosage determinations in, use of emulsions for, 17: 6323 (UCRL-9967)
sodium activation in, by fast neutrons, 17: 5736
1,10-PHENANTHROLINE
use of, in uranium analysis for iron, 17: 5962 (PG-Report-345)
PHENOL, 2,6-DI-*tert*-BUTYL-4-METHYL-
diffusion in polyformaldehyde and polypropene, 17: 5943
PHENOL, PENTACHLORO-
crystal structure, nuclear quadrupole resonance and x-ray studies, 17: 6112 (AFOSR-2541)
PHENOTHIAZINE
diffusion in propene polymer, 17: 5943
PHENOTHIAZINES
effectiveness in treatment of radiation sickness, 17: 5918
PHENYL BORATES
analysis for potassium in tetraphenylboron rubidium, flame photometric, 17: 5989
analytical use of tetraphenylboron sodium in determination of rubidium, 17: 5989
PHOSPHATE IONS
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)
PHOSPHATES
oxidative effects of inorganic, on metabolism of *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)
PHOSPHATIDES
radiation effects on liver mitochondrial in rats, 17: 5772 (TID-13322)
PHOSPHINE OXIDE, TRIOCTYL-
determination in uranium complexes by method of continuous variations, spectrophotometric, 17: 5955 (IÜL-74-PC)
PHOSPHINES
mass spectra of volatile, 17: 6791 (IS-424)
PHOSPHONATES
solvent properties of acidic, for thorium(IV), 17: 6189 (TID-15313)
PHOSPHORIC ACID
solvent properties of 2-ethyl hexyl, for metals, 17: 6188 (TID-15271)
PHOSPHORIC ACID, ALKYL ESTERS
diethylhexyl-solvent properties for uranium in sulfuric acid, 17: 6196
solvent properties for metals, 17: 6197

solvent properties for indium and tin, 17: 6200
PHOSPHORS
design and efficiency of multi-filament, 17: 7118 (NP-12330(p.199-201))
light yield of organic solution NE 213 from recoil protons, measurement, 17: 6119
preparation and properties of organic, 17: 7122 (NP-12330(p.220-3))
PHOSPHORUS
conversion of plasma to milk in lactating dairy cows, tracer study, 17: 5722
determination in hypereutectic aluminum-silicon system, activation, 17: 5994
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination of organic, micro colorimetric method, 17: 5675(R) (LAMS-2780(p.246-317))
metabolism in tumor cells, effects of radiation and temperature, 17: 5832
neutron reactions (n,α) with, direct interaction processes in, 17: 7094 (NP-12330(p.46-52))
nitrogen nucleus reactions at 27.5 Mev, 17: 7252
radiation effects on reactions of white, with carbon tetrachloride, 17: 6167
PHOSPHORUS ISOTOPES P-30
energy levels, 17: 7104 (NP-12330(p.119-21))
PHOSPHORUS ISOTOPES P-31
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
energy levels, 17: 7278
PHOSPHORUS ISOTOPES P-32
accumulation in aquatic insects, 17: 5702 (HW-SA-2848)
beta activity from, determination in sulfur disc neutron dosimeter, 17: 5969 (PG-Report-387)
beta activity of, design of 4π beta plastic scintillator for measurement of, 17: 6459
beta decay of, internal bremsstrahlung emission with, 17: 7152
deposition in north temperate latitudes of cosmic-ray produced, 17: 6840
preparation by distillation of neutron-irradiated sulfur, 17: 6141
production at Institute of Atomic Energy, apparatus and methods, 17: 6126 (IEA-49)
recoil of, in reactor-irradiated potassium chloride crystals, annealing behavior of, 17: 6160
therapeutic effects on polycythemia vera, 17: 5687
use in localization of brain tumors, by intra-arterial injections, 17: 5681
PHOTOELECTRIC CELLS
developments for space applications, 17: 6551
use in detection of ultraviolet radiation, 17: 6411 (WADD-TR-60-371)
PHOTOELECTRIC EFFECT
angular distribution dependence on gamma energy and target Z, 17: 6833
cross sections for K-shell, 17: 6851
PHOTOGRAPHIC FILM DETECTORS
performance for dosimetry of stratospheric radiations, 17: 5765 (AFCRL-62-244)
PHOTON SHOWERS
production by mesons (μ) at high energies, 17: 7044
PHOTONS
exchange in electron-photon scattering, 17: 7017
interactions in mesons (ρ-π) systems, constants for, 17: 7001
interactions with protons, Compton effect on, 17: 6792(R) (ISS 62/14)
reactions (γ,d) with light nuclei, mechanisms in, 17: 7185
reactions (γ,p) with bismuth-209, proton distribution from, 17: 7092 (NP-12330(p.35-8))
reactions on atoms, K-shell photoelectron emission from, 17: 6851
PHYSICAL CONSTANTS TESTING REACTOR
use in analysis of Phoenix fuel standards, 17: 5951 (HW-74796)
PHYSICS
statistical behavior of linear systems, 17: 6891
thermo-, research and development, 17: 6532 (WADC-TR-53-373(Suppl.9))
PHYSIOLOGY
research programs on cutaneous sensory aids and mechanisms, 17: 6801(R) (TID-17303)
PINCH DEVICES
plasma turbulence in, 17: 7492
x-ray production in theta pinch discharges from, 17: 7478
PINCH EFFECT
on electron density and magnetic field distribution, 17: 7477
PIPES
radioactivity buildup on, in reactors, determination by gamma spectroscopy, 17: 6574 (TID-15281)
ultrasonic inspection of welds in thick wall steel, 17: 6243 (HW-74597)
PITUITARY GLAND
radiation effects on, in mice, 17: 5872
radiotherapy of adenomas, 17: 5840
PLANARIA
radiation effect on the development of, 17: 5789
PLANETS
microwave radiation from Mercury, 17: 6907
origin of, 17: 6908
radio emission by Jupiter, origin of decameter, 17: 6912
PLANT CELLS
radiation injury kinetics in cell, 17: 5876
PLANTS
adaptation to cosmic conditions, 17: 5781(T) (FTD-TT-62-771)
beta activity measurement from, 17: 5972 (PG-Report-403)
carbon dioxide uptake and transport by, tracer studies of daily periodicity in, 17: 5756
contamination by iodine isotopes from nuclear explosions, 17: 6322 (UCLA-499)
effects on cesium-137 content of dried milk products, 17: 5752 (HW-SA-2337)
enzyme reaction mechanisms in, 17: 5696
radiation effects on physiological state of, 17: 5905
radiation effects of low gamma doses on yields, 17: 5827
PLASMA
application to space propulsion systems, 17: 6543
boundary layer of, in low-pressure discharge, 17: 7476
boundary layers and sheath potentials in shock-heated, in air, 17: 6899
characteristics of, in linear capacitative discharges, 17: 7449
collective motion in, 17: 7429 (TID-17336)
containment of heated, in magnetic traps, 17: 7485
containment of, sheath criterion for, 17: 7425 (MATT-77)
density distribution in column of, radial, 17: 7474
destructive effects of, from exploding wires, 17: 7495
diagnostics of P-4 steady-state, 17: 7432 (UCRL-6562)
diffusion in a weak magnetic field, ambipolar, 17: 7454
diffusion of rarefied, in a magnetic field, anomalous, 17: 7487
electric discharge in, electron density in, 17: 7437
electromagnetic wave propagation in multicomponent, Poynting vectors of, 17: 7438
electron beam injection in, equilibrium solutions for, 17: 7424 (DCAS-TDR-62-42)
electron density and magnetic field distribution in theta pinch, 17: 7477
electron distribution function in Lorentz, exposed to high-frequency electron field, 17: 7451
electron removal from, by refractory dust particles, 17: 7467
electron, single-particle excitations in dense, containing a positive point charge, 17: 6991
electronic thermal conductivity in magneto-, 17: 7468
energy level shifts and equation of state of, 17: 7484
experiments in Western Europe, review of high-temperature, 17: 7453
field fluctuations in electron, turbulent, 17: 7473
fluctuations in, theory of transformation and scattering of waves on, 17: 7483
generation of, by electromagnetically driven shock waves, 17: 7433 (UCRL-9971)
heating of, efficiency of turbulent, 17: 7485
heating of, feasibility of magnetohydrodynamic shear for, 17: 7427 (NP-12296)
helium, volume recombination in a magnetic field, 17: 7480
hydromagnetic wave propagation through, 17: 7472
injection of gas into vacuum, fast valve for, 17: 6216
instabilities in magnetic-mirror and toroidal, 17: 7448
instabilities of, in coaxial gas-triggered guns, 17: 7494
instability and damping in beam, 17: 7441
instability of, electromagnetic, 17: 7457

instability of nonthermal, 17: 7456
interaction with neutral gas, 17: 6908
interactions of electromagnetic waves with anisotropic, 17: 7421 (AFCRL-62-186)
interactions of shock-heated, with magnetic fields, 17: 7491
ionic mobility in, theory of, 17: 7426 (MATT-92)
ionic sound waves in, properties and applications of, 17: 7470
ionization energy of, in thermodynamic equilibrium, lowering of, 17: 7458
kinetics of, status of research programs on, 17: 7434 (UTIA-REV-18)
limits of the collective description of, and their consequences for Landau damping, 17: 7459
luminous phenomena accompanying explosion of thread-like channel of, time analysis of, 17: 7443
magnetohydrodynamic shock-wave structures in dense, 17: 6901
magnetohydrodynamic Alfvén-wave stability in incompressible, 17: 6845
measurement of electromagnetic waves in, design of instrumentation for, 17: 7420 (AD-275005)
microwave diagnostics of hot-cathode-discharge, 17: 7452
microwave emission from non-Maxwellian, 17: 7469
microwave emission by cold, at cyclotron harmonics, 17: 7435(T) (AEC-tr-5564)
microwave measurements on electron density in, 17: 7422 (AWRE-O-11/62)
model for electron-beam, derivation of "water-bag", 17: 7450
motion of, in toroidal electric discharge, effects of transverse magnetic field on, 17: 7445
motion of infinitely conductive, application of Hamiltonian and Lagrangian formulations to, 17: 7430 (UCRL-6387)
nonthermal impurity radiation from spherical, 17: 7464
oscillations in, collisional damping of, 17: 7460
oscillations in reflex-discharge, spectrum of, 17: 7471
oscillations of, relativistic effects on, 17: 7463
oscillations of, relativistic effects on, 17: 7462
particle motions in, review of collective, 17: 7490
pinch effect of electron-hole, in InSb, optical study of, 17: 7479
polarizability of plasmoids in, effect of internal thermal motion on, 17: 7482
positive column diffusion in magnetic field, 17: 7475
production of steady-state helium, 17: 7431 (UCRL-6561)
properties of low-temperature thermionic, 17: 7419 (AD-274920)
relaxation of electron and ion temperatures in fully ionized, in a strong magnetic field, 17: 7489
research on, review, 17: 7440
research programs on electronic and magnetohydrodynamic aspects of, 17: 6801(R) (TID-17303)
resonance in cylindrical, magnetoacoustical, 17: 7447
stability of, in nonvarying axial magnetic field, 17: 7428 (NP-12342)
stability of positive column, extension of theory to oscillations of finite amplitudes, 17: 7423 (D1-82-0211)
stability of spatially inhomogeneous, in magnetic field, 17: 7436(T) (NP-tr-928)
stability of two-stream, relativistic effects on, 17: 7463
stability of two-stream, relativistic effects on, 17: 7462
striations in h-f discharge, mechanisms for standing, 17: 7444
temperature of, determination by transmission time measurements on rays, 17: 7446
temperature relaxation rates of charged particles in, 17: 7481
thermal conductivity of ionized hydrogen, 17: 7439
transition region between uniform, and the confining magnetic field, 17: 7461
transport coefficients in fully ionized, condensed presentation of, 17: 7455
transport processes in, in a strong magnetic field, effect of radiation processes on, 17: 7488
turbulence in, review, 17: 7492
x-ray emission in theta pinch discharges, 17: 7478

PLASMA JETS
electric conductivity of, device for measuring, 17: 7493
instabilities in coaxial gas-triggered guns, 17: 7494
materials for space propulsion systems, 17: 6545
performance of a-c- and d-c, for space propulsion, 17: 7649
performance of crossed-field, for space propulsion uses, 17: 7647
spraying of refractory materials by, 17: 6556

PLASTICS
toxicity of, bibliography on, 17: 6318 (PLASTEC-NOTE-5)

PLATES
convection from vertical, free and natural, 17: 6233

PLATINUM
catalytic effects on hydrogen reactions, 17: 6098
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
gamma pair production cross sections for, 17: 7116 (NP-12330(p.186-92))
ion ranges in, determination from collection experiments, 17: 6820
neutron total cross sections for, thermal, 17: 7128 (NP-12330(p.369-77))
radiation effects on swelling of, 17: 6740(R) (EURAEC-380)
scattering of helium-3 particles by, 17: 6957 (TID-17357(Pt.I))
surface properties of, studies by mass spectrometry, 17: 6634 (AFOSR-2273)

PLATINUM ALLOYS
Pt–W, superconductivity of solid solutions of, 17: 6860

PLATINUM CHLORIDES
cyclopropane–platinum chloride, with recoil tritium atoms, 17: 6087

PLATINUM ISOTOPES Pt-192
energy levels and gamma spectra of, 17: 7151

PLATINUM METALS
formation by fusion of fission products in fission explosions, 17: 7242

PLOWSHARE PROJECT
industrial applications of nuclear explosions, 17: 6215
survey of bioenvironmental features of Ogotoruk Creek Area, Cape Thompson, Alaska, 17: 6273 (TID-17226)

PLUTONIUM
determination in poison standards for Phoenix fuels by neutron activation, 17: 5951 (HW-74796)
determination of ratio of, to uranium in feed solutions, 17: 5961 (PG-Report-340)
electronic structure in, effects of virtual bound states on, 17: 6701
evaluation of, as fuel for fast reactors, 17: 7551(R) (HW-74761 (p.7.1-28))
ionization potential, 17: 7195
movement in uranium dioxide during irradiation tests, 17: 6742 (HW-SA-2309)
separation from irradiated uranium fuel by solvent extraction, process for, 17: 5656(R) (KR-29)
separation from nitrate solutions by ion exchange, comparison with other actinides, 17: 6182 (IA-783)
separation from thorium, anion-exchange, 17: 6187 (TID-14598)
separation from uranium dioxide by electrolytic deposition in salt cycle process, 17: 7550(R) (HW-74761(p.6.1-20))

PLUTONIUM ALLOYS
Al–Pu, critical mass studies, 17: 7549(R) (HW-74761(p.5.1-35))
Al–Pu, properties, 17: 6512 (CRRM-1111)
Al–Pu, radiation effects, 17: 6512 (CRRM-1111)
Cr–Fe–Mo–Pu, mechanical properties of, 17: 6511(R) (BMI-1593(Del.))
Pu–U–fissium, separation from rhodium by anion exchange, 17: 5985
Pu–U–fissium, spectrophotometric analysis for rhodium, 17: 5985
Pu–Zr, cladding with zirconium, 17: 7547(R) (HW-74761(p.3.1-39))

PLUTONIUM CARBIDES
crystal structure, 17: 7547(R) (HW-74761(p.3.1-39))
preparation and properties, 17: 6637 (ANL-FGF-321)
thermal expansion, 17: 6662 (LA-2768)
thermodynamic properties, 17: 6052 (TID-17413)
PuC–UC, thermal expansion, 17: 6662 (LA-2768)

PLUTONIUM CHLORIDES
thermodynamic properties, 17: 6048 (TID-14538)

PLUTONIUM FIRES
control by extinguishant, 17: 6321 (TRG-Report-342)

PLUTONIUM(III) IONS
oxidation to quadrivalent state by chlorine, 17: 6057(T) (AEC-tr-5552)

PLUTONIUM ISOTOPES Pu-239
alpha spectra of, fine structure in, 17: 7277
fuel value in fast oxide breeder reactors, 17: 7545 (HW-72304)
nuclear magnetic moment, 17: 7195

PLUTONIUM ISOTOPES Pu-240
fission of, kinetic energy of fragments emitted in subbarrier, 17: 7300
neutron fission cross sections of, in low kev regions, 17: 7077 (EANDC(E)-37L)
PLUTONIUM ISOTOPES Pu-241
fuel value in fast oxide breeder reactors, 17: 7545 (HW-72304)
nuclear magnetic moment, 17: 7195
PLUTONIUM(IV) OXIDES
deposition with uranium dioxide, 17: 7550(R) (HW-74761(p.6.1-20))
heat capacity of, below 320°K, 17: 6049 (TID-15183)
thermal expansion, 17: 7547(R) (HW-74761(p.3.1-39))
$MgO-PuO_2$, fabrication and testing, 17: 7547(R) (HW-74761(p.3.1-39))
PuO_2-UO_2, electric conductivity, 17: 6536(T,R) (EURAEC-365)
PuO_2-UO_2, fabrication by cold swaging and vibrational compaction, 17: 7547(R) (HW-74761(p.3.1-39))
PuO_2-UO_2, fuel rod development of, 17: 7544 (HW-71232)
PuO_2-UO_2, preparation, 17: 6532(R) (NUMEC-P-51)
PuO_2-UO_2, radiation effects, 17: 6744 (HW-SA-2668)
PuO_2-UO_2, radiation effects, 17: 6745 (HW-SA-2675)
PuO_2-UO_2, sintering, 17: 6512 (CRRM-1111)
PuO_2-ZrO_2, fabrication and testing, 17: 7547(R) (HW-74761(p.3.1-39))
ReO_2-UO_2, radiation effects, 17: 6512 (CRRM-1111)
PLUTONIUM POISONING
therapy with diethylenetriaminepentaacetic acid, 17: 5706 (TID-14893)
PLUTONIUM RECYCLE TEST REACTOR
critical facility and fuel element rupture test facility design and construction, 17: 7556(R) (HW-74761(p.12.1-5))
development, 17: 7546(R) (HW-74761)
fuel elements for, radiation effects on, 17: 6745 (HW-SA-2675)
operation, April to June 1962, 17: 7556(R) (HW-74761(p.12.1-5))
prototype fuel elements for, radiation effects on, 17: 6744 (HW-SA-2668)
PLUTONIUM SYSTEMS
C–Pu, phase studies, 17: 6638 (ANL-FGF-343)
PLUTONYL NITRATES
spectra in nitric acid, absorption, 17: 6191(T) (CEA-tr-R-1514)
POCKET CHAMBERS
development of miniature, using transistors, 17: 6457
POLAROGRAPHS
design modifications using potential controlling circuit, 17: 6393 (HW-SA-2300)
POLISHING
wax lap use for vibratory, 17: 6516 (IS-439)
POLONIUM
absorption of subcutaneously injected in rats, effects of unithiol, 17: 5759
POLONIUM ISOTOPES
alpha decay systematics for, 17: 7199
POLONIUM ISOTOPES Po-210
alpha energies from, 17: 7173
determination of, in uranium ore concentrates and liquors, 17: 5964 (PG-Report-356)
determination of naturally-occurring in bovine bones and teeth, 17: 5705 (TID-14604)
energy levels at 1431 and 1478 kev, half lives of, 17: 7245
radiation sickness induced in rats by injected, 17: 5929
separation from bismuth-210 and lead-210 in nitric and perchloric acids, electrophoretic, 17: 6153
POLYCYTHEMIA
therapy with phosphorus-32, 17: 5687
POLYMERIZATION
post-effect, properties of polymers resulting from, 17: 5941(R) (TID-17239)
radiation effects on cross-, 17: 6764
radioinduced, in solid state, 17: 6155
POLYMERS
preparation of, by polycondensation of *p*-diethynylbenzene, 17: 6117(T) (SCL-T-446)
properties of, effects of monomer polymerization parameters on, 17: 5941(R) (TID-17239)
radiation effects on solutions, effects of sulfur, 17: 5923
radiation effects on molecular weights of, 17: 6764
research and development on, 17: 6532 (WADC-TR-53-373(Suppl.9))
yields in alpha radiolysis of *o*-terphenyl, 17: 6139
POLYPHENYLS
polymerization of, rates of thermal, 17: 6113 (HW-SA-2414)
POLYSACCHARIDES
radiation effects on metabolism, 17: 5828
POPULATIONS
cesium-137 content of Japanese, methods of measurement of, 17: 5691
cesium-137 content of Swedish Laplanders, 17: 5763 (AE-80)
gonad dose to, from dental radiography, 17: 6349
radiation effects on tumor incidence in Hiroshima and Nagasaki, 17: 6333
radiation hazards to, from radionuclides in foods and milk, 17: 6338
radiation hazards, 17: 5760
radiation hazards, 17: 5761
radiation injury kinetics in cell, 17: 5876
statistical analysis of Hiroshima and Nagasaki, for late effects of radiation, 17: 6332
PORTUGAL
fallout monitoring, spring 1960, 17: 6354
fallout monitoring, spring 1960, 17: 6355
fallout monitoring, 17: 5740
POSITRONIUM
decay rates of ortho-, in argon, freon, and helium, 17: 6882
POSITRONS
annihilation rates in metals, semi-empirical correlation of, 17: 6960 (UCRL-9793)
bremsstrahlung spectrum of, high-frequency region of, 17: 6983
interactions with electrons, cross sections for, 17: 7117 (NP-12330 (p.193-8))
scattering by nuclei, cross sections for EO transitions in, 17: 7269
POTASSIUM
concentration in cellular fluids, 17: 5694
determination in rubidium tetraphenylboron, flame photometric, 17: 5989
effects of dietary levels on excretion of cesium-137 and sodium in man, 17: 5713
scattering by mercury crossed beams, velocity dependence of differential cross sections for, 17: 6836
viscosity of saturated liquid, from 70 to 1150°C, 17: 6671 (NP-12366)
POTASSIUM ACETYLIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)
POTASSIUM ALLOYS
K–Na, corrosive effects on reactor materials, 17: 7565(R) (PWAC-161)
K–Na, corrosive effects on beryllium oxide, 17: 7606(R) (ORNL-1515)
K–Na, distillation, 17: 7606(R) (ORNL-1515)
POTASSIUM BROMIDE CRYSTALS
spectra of thallium-activated, emission, 17: 6858
POTASSIUM CHLORIDE CRYSTALS
electrification of dust from, radiation effects of beta rays on, 17: 6815
interactions of phonons with defects in, 17: 6800 (TID-15495)
radioinduced coloration and strain in, intensity dependence of, 17: 6866
radioinduced phosphorus-32 recoil in, annealing behavior of, 17: 6160
spectra of thallium-activated, emission, 17: 6858
POTASSIUM CHLORIDES
transfer between heavy and light water, ionic hydration in, 17: 6096
$KCl-UCl_4$, petrology, 17: 7606(R) (ORNL-1515)
POTASSIUM COMPLEXES
with uranyl acetate in aqueous solution, spectra of, 17: 6081
POTASSIUM IODIDE CRYSTALS
spectra of thallium-activated, emission, 17: 6858
POTASSIUM ISOTOPES K-39
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
POTASSIUM ISOTOPES K-40
determination in man by whole-body counting, 17: 5672(R) (LAMS-2780 (p.130-80))
determination in solution using scintillation detector, 17: 6446
POTASSIUM ISOTOPES K-41
energy levels from proton capture in argon-40, 17: 7177
POTASSIUM ISOTOPES K-42
isotopic exchange in illite, 17: 6102
production and use of, 17: 6171
tracer applications in industry, 17: 6372
POTASSIUM NITRATES

transfer between heavy and light water, ionic hydration in, 17: 6096
transport number of cation in fused, 17: 6080
POTASSIUM NITRITES
transport number of cation in fused, 17: 6080
POTASSIUM SODIUM TARTRATES
neutron-diffraction analysis of, 17: 6647 (BNL-5747)
POTASSIUM SULFATES
transfer between heavy and light water, ionic hydration in, 17: 6096
POTASSIUM TUNGSTATES
electrical properties, 17: 6658 (IS-433)
POWDERS
mixing conditions, tracer study of, 17: 6374
POWER REACTORS
description of Italian 30-Mw(t) organic, 17: 7618
design of gas-cooled ceramic-fueled and ceramic-moderated, 17: 7607 (ORNL-2752)
design of graphite-moderated sodium-cooled, 17: 7622
development of heavy water-moderated, 17: 7597(R) (DP-785)
development of heavy-water-moderated, 17: 7602(R) (HW-75725)
development of organic-cooled 30-Mw(t) Italian, 17: 7618
parameters of dynamic behavior of, 17: 7529 (AEEW-R-179)
pressure vessel design problems, 17: 7620
startup of, development of pulsed-neutron sources for use in, 17: 7541(R) (GEAP-4047)
survey of Western European, 17: 7621
POWER SUPPLIES
availability of r-f, for accelerators, survey of, 17: 7338 (BNL-6511 (p.306-17))
circuit for ion-getter pumps, 17: 6219
development of r-f, for long linacs, 17: 7337 (BNL-6511(p.303-5))
performance of a-c and d-c, for arc-jet space propulsion systems, 17: 7649
utilization of silicon diodes in 88-in. cyclotron, 17: 7412
PRASEODYMIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
neutron cross sections at 0.015 to 0.3 ev, 17: 7078 (IEA-51)
separation from lanthanum by double complexation and replacement, 17: 5986
separation from neodymium by displacement chromatography, band distribution in, 17: 6004
separation from neodymium by high temperature distillation of oxides, 17: 6070
separation from rare earths, 17: 6019
spectra of, effect of transitions in 4f shell on absorption, 17: 6099
PRASEODYMIUM CARBIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)
PRASEODYMIUM CHELATES
with 2-hydroxybenzophenone, emission spectra, 17: 6085
PRASEODYMIUM ISOTOPES
alpha decay systematics for, 17: 7199
PRASEODYMIUM OXYTELLURIDES
preparation and properties, and crystalline structure, 17: 6068
PRESSURE
measurement of, calibration of Bridgman anvils for, 17: 6410 (UCRL-9807)
PRESSURE GAGES
gas pressure measurement in pressure vessels using, 17: 6429(P)
PRESSURE VESSELS
air-tightness of, 17: 6210
closures for cylindrical, design of minimum-weight, 17: 6211
comparison for containment of boiling reactors, 17: 7626
design and fabrication of, for BONUS reactor, 17: 7600 (GNEC-210 (Suppl.1))
design for power reactors, 17: 7620
electric wire leads for internal instrumentation of, 17: 6408 (UCRL-6531)
gas pressure measurement in, apparatus for, 17: 6429(P)
nozzle stresses in, 17: 6246 (NYO-10147)
stresses in concrete, 17: 7500
testing of materials for, 17: 6248(T,R) (EURAEC-393)
welding of materials for, 17: 6248(T,R) (EURAEC-393)
PRESSURIZED WATER REACTORS
efficiency improvements, possible, 17: 7616
fuel burnup characteristics in, ceramic, 17: 6755
PRODUCTION REACTORS
safety in operation of, 17: 7628 (TID-15677)
PROLINE
analysis for tritium by continuous scintillation counting, 17: 5709
PROMETHIUM ISOTOPES
alpha decay systematics for, 17: 7199
PROMETHIUM ISOTOPES Pm-141
decay of isomers of, 17: 7294
PROMETHIUM ISOTOPES Pm-147
energy levels at 91 kev, half life of, 17: 7264
use as ionization chamber current reference standard, 17: 6461
PROMETHIUM ISOTOPES Pm-148
decay of, energy levels from, 17: 7181
PROMPT NEUTRONS
lifetime calculation of, using the statistical theory of neutron chain reactions, 17: 7061
PROPANE
particle tracks in, effects of pressure on, 17: 6472
radiolysis, effects of olefins on hydrogen production in, 17: 6145
PROPANE, 2-METHYL-
radiolysis of liquid, using 4.2-Mev electrons, 17: 6134 (UCRL-9924)
1-PROPANESULFONIC ACID, 2,3-DIMERCAPTO-
effects on absorption of subcutaneously injected polonium, 17: 5759
2-PROPANOL
photochemical oxidation by benzophenone, inhibition by disulfides and thiols, 17: 6146
PROPENE
reactions with hydrogen atoms and methyl radicals, 17: 6071
reactions with hydrogen atoms, 17: 6145
PROPENE, 2-METHYL-
reactions with hydrogen atoms, 17: 6145
PROPENE POLYMERS
diffusion of ionol and phenothiazine in, 17: 5943
PROPORTIONAL DETECTORS
background dependance on gas pressure and wall thickness in, 17: 6449
design and performance for neutron dosimetry, 17: 6477
use of gas-flow, for counting of carbon-14 compounds, 17: 6470
PROPULSION
arc-jet, performance of a-c and d-c systems for, 17: 7649
electron-bombardment ion rocket with alternating current, 17: 7644 (NASA-TN-D-1457)
ion-source characteristics for space-vehicle, 17: 6900
ion systems for, of stationary satellites, 17: 7648
ion systems for space, beam-neutralizer performance in, 17: 7646
materials for ion, 17: 6544
plasma accelerators for space, performance of crossed-field, 17: 7647
plasma systems for space, materials, 17: 6545
research programs on advanced nuclear, 17: 7538(R) (DCAS-TDR-62-44)
PROSPECTING
radiation protection in, using radioisotopes, 17: 6342
PROTACTINIUM ISOTOPES Pa-233
determination in human lungs, whole-body counting, 17: 5704 (TID-12790)
PROTACTINIUM ISOTOPES Pa-234
electron conversion spectra of metastable, 17: 7160
PROTEINS
effects of dietary levels on uptake of strontium by bone, 17: 5745
PROTON BEAMS
extraction from Univ. of Ill. cyclotron, 17: 7403
measurement of, in Rutherford linear accelerator, 17: 7330 (BNL-6511 (p.235-60))
measurements of Brookhaven-AGS preinjector, 17: 7342 (BNL-6511 (p.338-80))
production with sector-focused cyclotron, 17: 7394
production with 700 Mev cyclotron, 17: 7398
stability of, orbit calculations of, 17: 7353
transport system for, design for 10-Bev FFAG, 17: 7336 (BNL-6511 (p.294-302))
PROTON SOURCES

development of polarized, for 68-Mev linac, 17: 7341 (BNL-6511 (p.335-7))
PROTONS
acceleration and extraction in Univ. of Colorado cyclotron, 17: 7359
biological effects of extremely energetic, 17: 5770 (MDC-TDR-62-3)
Coulomb energies in light nuclei, 17: 7090 (NP-12330(p.17-21))
detection with organic phosphor NE 213, efficiency of, 17: 6119
dosimetry and biological effects in stratosphere, 17: 5765 (AFCRL-62-244)
electron energy level excitation in atomic hydrogen by fast, 17: 6861
emission by decaying nuclei, 17: 7082 (JINR-P-1072)
emission of delayed, in positron decay of neutron-deficient nuclei, 17: 7169
exchange between heavy water and ribonuclease, spectra of, 17: 6073
interactions with photons, Compton effect on, 17: 6792(R) (ISS 62/14)
interactions with mesons (π^+), resonances in, 17: 6997
interactions with mesons (K^+), production of meson (K^*) resonance in, 17: 7000
interactions with antiprotons, meson (π)-nucleon anti-isobar-isobar production in, 17: 7002
interactions with mesons (π^+), N_1^* isobar production in, 17: 7002
interactions with mesons (π) at high energies, cross sections of, 17: 7013
interactions with mesons (π^-), meson (M) production in, 17: 7014
interactions with electrons, two-photon exchange in, 17: 7017
interactions with mesons (π^+), threshold singularities in total cross sections for $K^+\Sigma^+$ formation, 17: 7033
interactions with mesons (π^-) at 7.2 Bev, π-π interactions in multiple production of mesons (π) in, 17: 7035
interactions with protons at 660 Mev, 17: 7041
interactions with mesons (π) at high energies, role of vector mesons in elastic, 17: 7045
interactions with electrons taking into account dipole moments, 17: 7050
interactions with antiprotons, meson production in, 17: 6947 (IA-768)
interactions with protons at 640 Mev, singlet phase shifts in, 17: 6949 (JINR-D-1073)
interactions with neutrinos, cross sections for meson (K^+) production in, 17: 6953 (LNF-62/89)
interactions with antiprotons at 0.5 to 1.0 Bev, cross sections for, 17: 6959 (UCRL-9288(Rev.))
interactions with neutrons at 0.4926 and 3.205 Mev, precision measurements of the total cross section of, 17: 6976
interactions with mesons (π^-) at 152 and 226 Mev, elastic, 17: 6977
interactions with antiprotons, protons, and mesons (π), one-pion-exchange contributions to, 17: 6980
interactions with light nuclei at high energy, 17: 7209
interactions with deuterons, neutron spectra from, 17: 7241
meson (μ^-) capture by, radiative, 17: 7047
polarizability of, magnetic, 17: 7025
polarization in deuteron reactions (d,p) with carbon-12 at 0.8 to 1.2 Mev, 17: 7271
polarization of, in nickel–palladium alloys, 17: 6945 (BNL-5648)
polarization of recoil, in (γ,3π) reactions, 17: 7007
reaction (p,γ) with argon-40 at 8.92 kev, energy levels from, 17: 7177
reactions in sodium chloride crystals at 1.55 Bev, detection of, 17: 7261
reactions on helium, excitation and polarization from, 17: 7263
reactions on lithium-6, cross sections and Q-values of, 17: 7200
reactions on nuclei, proton distributions from, 17: 7197
reactions (p,α) and (p,γ) on aluminum-27, energy levels from, 17: 7262
reactions (p,α) with lithium-7 at 1 to 3.2 Mev, 17: 7272
reactions (p,α) with boron-11 at 140 to 550 kev, angular distribution of alpha particles from, 17: 7163
reactions (p,α) on aluminum-27, distributions from, 17: 7168
reactions (p,α) with lithium-7, excitation of beryllium-8 in, 17: 7179
reactions (p,d) at 25 to 30 Bev, 17: 7258
reactions (p,d), (p,π), (p,K), (p,n), and (p,t) with aluminum, beryllium and iron at 30 Bev, 17: 7259
reactions (p,d) with boron-11, carbon-14, oxygen-16, and oxygen-18, 17: 7217
reactions (p,γ) on carbon-12, spectra from, 17: 7153
reactions (p,n) with copper-63, copper-65, manganese-55, scandium-45, and vanadium-51, cross sections for, 17: 7144 (TID-17357(Pt.III))
reactions (p,p') with copper-63 and copper-65, cross sections for, 17: 7144 (TID-17357(Pt.III))
reactions (p,πn) with carbon-12 at 0.25 to 6.2 Bev, recoil ranges from, 17: 7147 (UCRL-9911)
reactions (p,t) with carbon-14 and oxygen-18, 17: 7217
reactions (p,xn) and (p,2pxn) with tellurium-125 and -126 at 120 to 660 Mev, cross sections for, 17: 7297
reactions (p,3pn) with aluminum-27 at high energies, recoil study of, 17: 7230
reactions with aluminum-27 and fluorine-19, 17: 7173
reactions with bismuth and lead at high energies, formation of astatine-207 and -209 in, 17: 7276
reactions with boron-10, differential cross sections for, 17: 7176
reactions with emulsion nuclei at 9 Bev, angle and energy measurements of, 17: 6971
reactions with heavy nuclei at 600 Mev, fission phenomena in, 17: 7086 (NP-12319)
reactions with niobium nuclei at 240 to 880 Mev, 17: 7149 (UCRL-10461)
scattering by carbon-12 at 182 Mev, 17: 7265
scattering by carbon at 660 Mev, differential cross sections for elastic, 17: 7081 (JINR-P-1025)
scattering by carbon-12 at 31.1 Mev, elastic and inelastic, 17: 7243
scattering by carbon-12, polarization from elastic, 17: 7166
scattering by oxygen at 8.66 to 19.2 Mev, optical model analysis of elastic, 17: 7235
scattering by thin films, energy-loss spectra from, 17: 7157
scattering of, angular distribution for inelastic, 17: 6957 (TID-17357(Pt.I))
scattering on copper and nickel at 6.6 Mev, inelastic, 17: 7178
spallation of copper by, at 3 and 30 Bev, energy dependence of product yields, 17: 7233
PSEUDOUREA, 2-(2-AMINOETHYL)-2-THIO-
metabolism in mice, tracer study, 17: 5908 (SAM-TDR-62-68)
protective effects against radiation injury to gastrointestinal tract, 17: 5891
PUERTO RICO POWER REACTOR
design, safety aspects of, 17: 7625
pressure vessel design and fabrication, 17: 7600 (GNEC-210 (Suppl.1))
PULSE ANALYZERS
design, 17: 7120 (NP-12330(p.209-13))
design and development of, 17: 6132(R) (TID-17272)
design of fast integral discriminator using tunnel diodes, 17: 6399 (LNF-62/73)
timing circuitry for, 17: 6435 (IEA-50)
PULSE GENERATORS (ELECTRONICS)
design of, for use in nuclear instrumentation, 17: 6387 (CEA-2198)
PULSES
coding in photographs of oscillograph traces, 17: 6469
observation of photomultiplier, using oscilloscope, 17: 6468
PUMPS
seals for, fabrication by hot pressing, 17: 7606(R) (ORNL-1515)
PUREX PROCESS
waste processing in, cesium concentration and purification during, 17: 7550(R) (HW-74761(p.6.1-20))
PYRENE
emission and fluorescence behavior of, in cyclohexane and paraxylene, 17: 5938 (TID-13249)
PYRIDOXINE
effectiveness in treatment of radiation sickness, 17: 5918
protective effects of, and sulfur derivatives, against radiation injuries in mice, 17: 5930
PYRROLIDONE, VINYL-
polymerization of, graft, 17: 6511(R) (BMI-1593(Del.))
PYRUVATES
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)

Q

QUANTUM ELECTRODYNAMICS
asymptotic representations of the Green's functions and vertex

function in, 17: 7525
mass gauge invariance of elementary particles, 17: 7015
of neutrinos, cosmological effects of, 17: 7005
QUANTUM MECHANICS
book: *Mathematical Apparatus of the Theory of Angular Momentum*, 17: 7527(T)
book: *Quantum Theory of Scattering*, 17: 7053
field theory, space-time approach to, 17: 7514
Green's functions in multi-phonon transition theory, 17: 6887(T)
relativistic, central forces in, 17: 6885
relativistic particle equations in, unified theory for, 17: 6963
role of short-range three-particle forces in processes with the generation of three particles near threshold, 17: 7518
rotational motion in many-particle system, 17: 6956 (TID-13705)
solution of exterior boundary value problems for the wave equation, 17: 6503 (TID-14920)
statistics of a many-body system with several components, 17: 7511
statistics of elementary particle interactions, isobaric scheme for, 17: 6967
surface divergences in the Bogolyubov method, 17: 7516
theory of quantum generators, 17: 7523
theory of relativistic, partial wave amplitudes in, 17: 6894
three-body problem for short-range forces in the linear approximation in the force range, 17: 7517
wave functions for electron pairs in beryllium atom, 17: 6842
QUARTZ CRYSTALS
development and performance for continuous scintillation counting of carbon-14 and tritium, 17: 5709
electron spin resonance of radiation-produced defects in doped, 17: 6749 (TID-15542)
QUARTZ FIBERS
use of plugs of, for prevention of ignition spattering in crucibles, 17: 5976 (TID-14592)
8-QUINOLINOL, 2-METHYL-
analytical use in spectrophotometric determination of cerium, 17: 5988
QUINONES
content in irradiated tissues, 17: 5880
electron spin resonance spectra of semi-, in solution, 17: 5692
protective effects against x radiation in yeast cells, 17: 5919
trisethyleneiminophenyl-, effects on bone marrow transfusions in man, 17: 5921

R

RABBITS
radiation effects on iron content in blood plasma in, 17: 5826
radiation effects on blood picture in, 17: 5853
radiation sickness of, effects of transplantation of fresh and preserved spleen on, 17: 5926
skin protection by pericental opening in sieve irradiation, 17: 5898
RADIATION
biological effects, 17: 5760
biological effects, 17: 5761
book: *Radiation and Health*, 17: 5906
carcinogenic effects, in chronic ingestion of iodine-131 by sheep, 17: 5768 (HW-SA-2493)
chromosome aberrations induced in tumor cells by, effects on cell viability, 17: 5890
detection using bubble chambers, effects of pressure on, 17: 6472
dosage determinations for personnel using radioisotopes in industry and research, 17: 6320 (TID-16553)
dosage determinations for sterilization of grain weevils, 17: 6368
dosage distributions in moving field irradiation, effects of position of position of pendulum axis on, 17: 6358
dosages from rotational irradiation at 100 kev to 17 Mev, effects of energy on surface burden in, 17: 6359
dose inhaled after reactor accident, measurement, 17: 6327
dose rates from patients receiving radioiodine therapy, 17: 6360
dosimetry, 17: 5748
effects of exposure during pregnancy on incidence of mongolism in offspring, 17: 5848
effects of internally deposited, on nervous response in rats, effects of hypothermia, 17: 5889
effects on active and passive immunity to bone marrow transplantations in mice, 17: 5916
effects on blood picture in rabbits, 17: 5853
effects on calcium resorption by bone tissue, 17: 5901
effects on cerebral and cranial bones after therapy of parotid gland, 17: 5849
effects on chromosome structure in barley and wheat, 17: 5903
effects on cleavage of gametes in *Arbacia punctulata*, recovery from, 17: 5895
effects on enzymes, reaction mechanisms, 17: 5767 (BNL-5727)
effects on heart activity, 17: 5782(T) (JPRS-15872)
effects on iron content in blood plasma in rabbits, 17: 5826
effects on iron metabolism in mice, 17: 5913(T)
effects on lipid content and hormone activity of testes, 17: 5842
effects on luminescence of blood and bone marrow in rats, 17: 5852
effects on man in space, 17: 5868
effects on masculinization of submaxillary glands in rats, 17: 5800
effects on peripheral blood luminescence, 17: 5823
effects on plants, 17: 5905
effects on properties of fibrinogen, 17: 5799
effects on reaction of mice to injected hematopoietic tissue, 17: 5802
effects on skin of guinea pigs, protective effects of cortisone against, 17: 5915
emission by uniformly rotating point charge in dielectric medium, 17: 6797 (PIBAL-753)
from atomic explosion, late effects on human populations, 17: 6332
from atomic explosion, effects on incidence of tumors in human populations, 17: 6333
genetic effects, 17: 5876
genetic effects, reaction mechanisms, 17: 5875
genetic hazards to Canadian population from diagnostic uses, 17: 6335
measurement units and conversion factors, 17: 5760
measurement units and conversion factors, 17: 5761
pathological effects on heart, whole-body exposure, 17: 5912
pathological effects, 17: 6330
permissible exposure levels, 17: 5760
permissible exposure levels, 17: 5761
physiological effects, 17: 5876
shielding, methods and principles of, 17: 7499
standards development and administration in U.S., 1962, 17: 5760
standards development and administration in U.S., 1962, 17: 5761
use in organic compound synthesis, 17: 6176(P)
RADIATION CHEMISTRY
chemical effects of nuclear transformations, 17: 6136
chemical reactions initiated by fission energy, 17: 6161
effects of pre-irradiation on subsequent nuclear transformations, 17: 7133 (NP-12330(p.407-14))
RADIATION DAMAGE
microscopic examination of, electron, 17: 6746 (MRL-126)
RADIATION DETECTION INSTRUMENTS
calibration of, rotating rig for, 17: 6475
design and performance of isothermal calorimeter for reactor dosimetry, 17: 6452
design and performance for intermediate-energy neutrons, 17: 6478
design for measuring gamma emitters in liquid, 17: 7555(R) (HW-74761(p.11.1-14))
neutron flux measurement in reactors using, 17: 6489(P)
performance during Operation Hardtack, 17: 6317 (OTO-58-3)
performance for neutron spectra measurements around nuclear installations, survey of, 17: 6482
standardization of Radsan neutron detector, 17: 6443 (USNRDL-TR-598)
RADIATION DETECTION INSTRUMENTS (AUDIO PULSE TYPE)
development of miniature, for personnel monitoring, 17: 6457
RADIATION DETECTION INSTRUMENTS (COLORIMETRIC)
range of Fricke dosimeter, extension of, 17: 6430 (BNL-763)
use of iron-59 tracer in Fricke dosimeter for low doses, 17: 6453
RADIATION DETECTION INSTRUMENTS (ION CURRENT TYPE)
design of arm counter, 17: 5677 (TID-14613)
design of whole-body scanner, 17: 5684
RADIATION DETECTION INSTRUMENTS (PULSE TYPE)
design and efficiency of scintillation, for fast neutrons, 17: 7118 (NP-

12330(p.199-201))
design of gamma, with electronic scaler, 17: 6460
design of self-powered, for alpha and beta particles and gamma radiation, 17: 6433 (HW-71354)
RADIATION DETECTORS
analysis for beta activity in sulfur disc neutron, due to phosphorus-32, 17: 5969 (PG-Report-387)
dead-time correction calculation for absolute activity measurement using beta-gamma coincidence, 17: 6455
description of gamma and neutron, 17: 6447
design and performance for fast flux measurement in zero-energy reactors, 17: 6483
design and performance of neutron thermopile, 17: 6485
development, 17: 6315 (ORNL-1559)
development of regenerating, for in-core flux measurement, 17: 7555(R) (HW-74761(p.11.1-14))
performance for dosimetry of mixed neutrons and gamma radiation, 17: 5774 (TID-13984)
performance for neutron dosimetry, 17: 5780 (USNRDL-TR-583)
perturbing effects on thermal neutron flux in diffusing media, 17: 6484
shielding for, 17: 6486(P)
RADIATION EFFECTS
on materials in liquid hydrogen propelled nuclear rockets, 17: 6542
on metals and other high-melting materials, 17: 6768
on polymers in solution, effects of sulfur, 17: 5923
RADIATION INJURIES
case histories in early radiologists, 17: 5804
diagnosis using luminescence microscopy, 17: 5823
effectiveness of antibiotic therapy in mice, 17: 5917
effects of age and genetic factors in mice and hamsters, 17: 5779(R) (UCSF-22)
immediate detection, 17: 5813
kinetics in cell populations, 17: 5876
of bone marrow, chemical protection, 17: 5831
of central nervous system, effects on response to chemical radiation protection, 17: 5886
of central nervous system, effects of head exposure, 17: 5887
of eyes following exposure to therapeutic doses, 17: 5794
of hematopoietic system, screening tests on effects of various compounds on recovery, 17: 5910 (TID-17379)
of intestine, anoxic protection by intra-arterial catheterization, 17: 5667 (BNL-5798)
of thymus cells in tissue culture, chemical protection, 17: 5922
of ureter, prophylactic effects of prednisolone treatment, 17: 5820
of urinary bladder following radium treatment of carcinoma of the cervix, 17: 5787
of urinary tract from radiotherapy of uterine carcinoma, 17: 5819
protection against in gastrointestinal tract, effects of amino-ethylisothiuronium, 17: 5891
protection against, effects of pyridoxine and its sulfur derivatives, 17: 5930
protection against, effects of tryptamine derivatives, 17: 5931
protection against in *Escherichia coli*, effects of cysteamine, 17: 5932
protective effects of adenosine triphosphate and diphosphopyridine nucleotide in chick embryos, 17: 5914
protective effects of acylated derivatives of MEA against, in mice, 17: 5924
recovery rate, effects of radiation dose, 17: 5909 (TID-14019)
therapy, effectiveness of phenothiazines, pyridoxine, and other drugs, 17: 5918
therapy, effects of injected fetal tissues in mice, 17: 5810
therapy of, using bone marrow transplantation, 17: 5920
therapy using bone marrow transfusions in man, 17: 5921
treatment, 17: 6325(T) (JPRS-16072)
treatment, effects of bone marrow infusions, 17: 5683
RADIATION MONITORING
of rain water in New Zealand, 17: 5758
using silver halide emulsions, 17: 6487(P)
RADIATION PROTECTION
for firefighters, survey on, 17: 6326(T) (UCRL-Trans-838(L))
laboratory methods of, for veterinarians, 17: 6319 (TID-15445)
procedures for, used during Operation Hardtack, 17: 6317 (OTO-58-3)
rules for, 17: 6361
rules for personnel handling radioisotopes in geological exploration, 17: 6342
RADIATION SICKNESS
effects on resistance to infections, effects of thyroid hormones, 17: 5885
effects on synthesis of serum albumin in liver, 17: 5928
pathology and regeneration of associated gastrointestinal lesions, 17: 5929
therapy, effects of antibiotic, 17: 5911(T) (JPRS-16471)
therapy using *Aralia*, leukogen, and *Restharrow* preparations on, 17: 5927
therapy using blood transfusions, effectiveness of, 17: 5925
therapy using fresh and preserved spleen transplantation in rabbits, 17: 5926
RADIATION TARGET CANS
heat transfer between contents and, correlation between experiment and theory, 17: 6237
operation in Argonne Research Reactor, 17: 7630 (ANL-6554)
RADIATION TARGETS
fabrication of cryogenic, use of mylar in, 17: 6808 (UCRL-9824)
RADIO WAVES
absorption in ionospheric D layer, 17: 6927
emission by Jupiter, origin of decameter, 17: 6912
RADIOACTIVE CONTAMINATION
control of, in nuclear power plant heat transfer systems, 17: 7587(P)
RADIOACTIVE MATERIALS
activity measurements using anticoincidence, 17: 6451
determination in atmosphere by filtration and autoradiography of filters, 17: 6792(R) (ISS 62/14)
measurement of beta emitters in solution using sciatillation detector, 17: 6446
radiography using rotating lead disk with collimating slits, 17: 6419
RADIOACTIVITY
atmospheric, in Moscow, 1958, 17: 6286
content in water supplies in Britain, 17: 6337
definition of curie units, 17: 5660
effect on microwave emission from planet Mercury, 17: 6907
measurement of absolute, calculation of dead-time corrections for coincidence method, 17: 6455
measurement of atmospheric, in nuclear reactor environment, 17: 6290
measurement of, in diet in Britain, 17: 6336
measurements in plants and soils in USSR, 1958, 17: 6288
measurements of alpha and beta, in air, 17: 6287
measurements of natural, in open waters and soils, 17: 6341
of electronic components and glass, 17: 6415
problems with high-energy accelerators, 17: 7401
RADIOBIOLOGY
book: *Radiation and Health*, 17: 5906
cosmic radiation hazards in space, 17: 6305 (BNL-6501)
electron spin resonance applications in, 17: 5692
immediate detection of x irradiation, 17: 5813
radiation effects on plants, review, 17: 5905
radiation protection in sieve irradiations, 17: 5898
research activities at Los Alamos Scientific Laboratory, 1961 and 1962, 17: 5669(R) (LAMS-2780)
research on, in Germany, 17: 5698
RADIOCHEMICAL PROCESSING PLANTS
analysis of solutions for plutonium/uranium ratio determination, 17: 5961 (PG-Report-340)
design and operation in Western Europe, 17: 6199
development, 17: 6192(T,R) (EURAEC-382)
RADIOCHEMISTRY
development in USSR, 17: 6369
statistical theory, 17: 6137
RADIODERMATITIS
case histories in early radiologists, 17: 5804
RADIODIAGNOSIS
chromosome aberration after, in man, 17: 5846
developments review, 1962, 17: 5662
genetic hazards to Canadian population, 17: 6335
gonadal exposure during, of hip joint in children, 17: 6351

in pregnant women, effects on leukemia incidence in newborn children, 17: 5803
of brain tumors using intra-arterial phosphorus-32, 17: 5681
of heart diseases using iodine-131, 17: 5685
on internal tumors by preferential uptake of radioisotopes, 17: 5684
RADIOFREQUENCY OSCILLATORS
output of ORNL 88-inch cyclotron, 17: 7380
RADIOFREQUENCY SPECTROMETERS
design and performance of, using low magnetic fields, 17: 7126 (NP-12330(p.259-76))
sensitivity of, for electron resonance observations, 17: 6413(T) (SCL-T-449)
RADIOGRAPHY
design of pinhole camera for, and photography in dentistry, 17: 5688
diagnostic, leukemia incidence in children exposed *in utero* during, 17: 5803
effects of diagnostic chest exposure on incidence of leukemia, 17: 5816
gonad dose in dental, 17: 6349
gonadal dose from chest, in infants, 17: 6352
of radioactive specimens, using rotating lead disk with collimating slits, 17: 6419
shielding requirements for diagnostic dental, 17: 6344
techniques development for, 17: 5980 (TID-15512)
RADIOISOTOPES
adsorption of, design of system for remote operations, 17: 5942 (UCRL-9659)
book: *Handbook on Toxicology of Radioisotopes*, 17: 5748
detection and measurement of preferential uptake in internal tumors, 17: 5684
determination in food and water supplies, spectrometric, 17: 5733
determination in urine, bibliography on, 17: 5981 (VDIT-66)
determination of short-lived, 17: 6028
handling and use of short-lived, 17: 6133 (TID-17337)
handling of, device for opening sealed containers in, 17: 6214
handling of, in laboratories, 17: 6319 (TID-15445)
industrial and research used, radiation dose to personnel, 17: 6320 (TID-16553)
industrial uses in Soviet Russia, survey, 17: 6369
industrial uses in Norway, 17: 5656(R) (KR-29)
maximum permissible concentrations of, in airborne effluents, 17: 6308 (CRER-1098)
measurement of absolute activity using beta-gamma coincidence, calculation of dead-time corrections for, 17: 6455
preparation of vacuum-evaporated samples of, 17: 6158
production and distribution of short-lived, in UK, 17: 6370
production and uses in Europe, 17: 6156
production in Korea, 17: 6371
production in reactor facilities, 17: 6169
production of short-lived, in VVR-M Reactor, 17: 6170
removal of, from Columbia River by natural processes, 17: 6310 (HW-SA-2411)
tracer applications in industry, 17: 6372
use in activation analysis of short-lived, 17: 6029
use in activation analysis of short-lived, 17: 6031
use in neutron activation analysis, 17: 6026
use in reactor fuel materials study, 17: 7584
use of short-lived, in powder mixing studies, 17: 6374
use of short-lived, in aerosol movement studies, 17: 6375
uses in plant research, 17: 5905
RADIOLOGICAL WARFARE
food contamination in, protection from harmful effects of, 17: 6338
food contamination, 17: 6340
hazards to man near ground zero, 17: 6347
treatment of radiation injuries, 17: 6325(T) (JPRS-16072)
RADIOLOGICAL WARFARE AGENTS
food contamination, 17: 6339
RADIOLOGY
diagnostic, radiation dose to man from, 17: 6348
occupational exposure of pioneers, case histories of 160 with excessive exposure, 17: 5804
RADIOMETRIC ANALYSIS
scintillation methods for, 17: 6444(T) (AEC-tr-5259)
RADIOSENSITIVITY
effects of ancestral radiation exposure in mice, 17: 5777 (TID-15181)
effects of previous exposure in mice, 17: 5776 (TID-14698)
of chromosomes, calculation of oxygen effect, 17: 5833
of desoxyribonucleic acid synthesis in spleen lymphocytes, 17: 5830
of female genital tumors, 17: 5865
of lysine decarboxylase in *Bacterium cadaveris*, 17: 5829
of mice, effects of various variables, 17: 5671(R) (LAMS-2780(p.85-129))
of rat epithelioma, 17: 5812
of tumors of uterine cervix, 17: 5869
of tumors of uterine cervix, possibility of increasing, 17: 5870
RADIOSTERILIZATION
of pork, effects of moisture on thiamine retention, 17: 6365
of pork sausages, effects on storage life, 17: 6367
RADIOTHERAPY
developments review, 1962, 17: 5662
of bladder neoplasms, hemorrhage from, 17: 5805
of cancer, effectiveness of, 17: 5779(R) (UCSF-22)
of carcinoma of cervix with radium implants, late injury to urinary bladder and rectum, 17: 5787
of carcinoma of uterine cervix, effects on urinary tract, 17: 5815
of carcinomas of uterine cervix, proctitis after, 17: 5893
of fibrous dysplasia, development of jaw bone sarcomas following, 17: 5866
of gynecologic cancer, cytologic evaluation, 17: 5864
of head and neck, effects on ear, 17: 5896
of malignant neoplasms, effects on peripheral blood picture in man, 17: 5850
of parotid gland in child, effects on cerebral and cranial bones, 17: 5849
of pituitary adenomas, 17: 5840
of thyroid gland, effects on leukocyte chromosomes, 17: 5845
of uterine carcinoma, effect of dose on urologic complications, 17: 5819
recent advances, review, 17: 5873
recent developments, review, 17: 5871
research on, in Germany, 17: 5698
supervoltage, evaluation of cost and effectiveness, 17: 5682
tissue heterogeneity compensators for, in high-energy, 17: 5680
use of cesium-137 for, 17: 5697
RADIUM
content in open waters, 17: 6341
determination in solutions using nuclear emulsions, 17: 6003
distribution in human organisms, 17: 6341
leaching from rocks, geochemical, 17: 6281
therapeutic use in treatment of gynecologic tumors, effects on blood coagulation, 17: 5818
RADIUM ISOTOPES
determination in natural waters of Hungary, 17: 6293
RADIUM ISOTOPES Ra-226
determination of naturally-occurring in bovine bones and teeth, 17: 5705 (TID-14604)
RADIUM ISOTOPES Ra-228
content in bone after injection of Thorotrast, 17: 5707 (TID-15308)
RADON
content in open waters, 17: 6341
RADON ISOTOPES
determination in natural waters of Hungary, 17: 6293
RAIN WATER
deposition of beryllium-7 and phosphorus-32 in, at north temperate latitudes, 17: 6840
radiation monitoring of, in New Zealand, 17: 5758
radioisotope levels in, 17: 5751(R) (HASL-132)
strontium-89 and -90 content in, in New Zealand, 17: 5750(R) (DXRL-F6)
RAMJETS
materials requirements for nuclear, 17: 6546
materials technology of, application to space missions, 17: 6543
RARE EARTH ACETATES
preparation of anhydrous, by desolvation, 17: 6082
RARE EARTH COMPOUNDS
preparation and properties of lactates, 17: 6039 (IS-445)
RARE EARTH SULFATES

thermal decomposition at 800 to 1400°C, 17: 6054 (UCRL-6500)
RARE EARTHS
analysis and determination, methods for, 17: 6018
book: *Analytical Chemistry of Rare Earths*, 17: 6024
chemistry of, compared with actinides and transition metals, 17: 6090
chemistry of, compared with actinides and transition metals, 17: 6091
determination by ignition, prevention of spattering in, 17: 5976 (TID-14592)
electronic structure in, systematics of, 17: 6701
separation from chloride solutions by solvent extraction using mono-2-ethyl hexyl phosphoric acid, synergistic effects in, 17: 6188 (TID-15271)
RATE METERS
design and operation of transistorized logarithmic count, 17: 6432 (HW-66899)
design and performance of, for gamma and x-ray dosimetry, 17: 6471
design of gamma, with electronic scaler, 17: 6460
development for rapid screening of persons after accidental neutron exposure, 17: 5775 (TID-14529)
dosimetry at x-ray beam edge in air and water, effects of size on, 17: 6445
RATS
analysis for chloride in fluids and tissues in, by isotope dilution, 17: 5999
breast tumors in, chemical and radioinduced, 17: 5839
calcium content in epiphyseal cartilage in tibia of, electron probe for measurement of, 17: 5727
conditioned avoidance to x radiation in, 17: 5837
effects of irradiation on response to barbiturates, whole-body exposure, 17: 5788
fluorine and strontium-90 effects on hematopoietic system in, 17: 5822
iodine-131 ingestion by kangaroo, in desert environment, 17: 6322 (UCLA-499)
perception of x radiation by, physiological receptor mechanisms of, 17: 5857
radiation effects on jaws and teeth of, gamma and 200-kv x, 17: 5867
radiation effects on fatty acid and glucose transport by small intestine, 17: 5933
radiation effects on swimming times, 17: 5934
radiation effects on oxidative phosphorylation in liver mitochondria in, 17: 5784
radiation effects on cholesterol and fatty acid synthesis in liver in, 17: 5792
radiation effects on masculinization of submaxillary glands in, 17: 5800
radiation effects on luminescence of blood and bone marrow in, 17: 5852
radiation injuries in, therapeutic effects of *Aralia*, leukogen, and *Restharrow* on, 17: 5927
radiosensitivity of epithelioma, 17: 5812
radiosensitivity of gonads in immature female, effects of hormones, 17: 5838
REACTION MECHANISMS
kinetic isotope effect of carbon-14 in Beckmann rearrangement, reverse, 17: 6065
kinetics of fast interfacial, 17: 6584
REACTOR COMPONENTS
radiation effects on non-metallic, 17: 6750 (TID-17382)
REACTOR CONTROL RODS
radioinduced heating by neutron capture in rod poisons, 17: 7565(R) (PWAC-161)
shielding of withdrawn, 17: 7586(P)
theory of effects of, in homogenized reactors, 17: 7581
REACTOR CONTROL SYSTEMS
development, 17: 7542(R) (GEMP-75)
neutron transfer functions for spatial dynamics in, 17: 7531 (AEEW-R-197)
transfer functions for, computer program for derivation of, 17: 7530 (AEEW-R-189)
REACTOR COOLANTS
burnout conditions for flow of boiling water, in vertical round ducts, 17: 7528 (AE-87)
corrosive effects of liquid alkali metals, 17: 6557
decompression of, 17: 7532(R) (ARF-K6018-3)
heat transfer properties of gaseous and liquid metal, 17: 7606(R) (ORNL-1515)
purification of organic, 17: 7561 (NAA-SR-7362)
testing of organic, for film forming potential, apparatus for, 17: 7561 (NAA-SR-7362)
REACTOR COOLING SYSTEMS
design of, allowing access to fuel element channels, 17: 7591(P)
design of, for shielding withdrawn control rods, 17: 7586(P)
REACTOR ENGINEERING
design code for cylindrical reactor (POLLY) for IBM-650, 17: 6495 (CNEN-140)
hydrodynamic instability effects on boiling reactors, 17: 7539(R) (EURAEC-384)
program of, in Germany, 17: 7582
REACTOR EXPERIMENTAL FACILITIES
shielding requirements at beam tubes, 17: 7503
REACTOR FUEL ALLOYS
analysis of fissium, for rhodium, 17: 5985
properties of uranium-fission, effects of technetium on, 17: 6718
REACTOR FUEL ELEMENTS
characteristics of materials for rocket, 17: 6547
cladding, 17: 7571 (TID-17402)
cladding contamination of, control by alpha monitoring, 17: 6434 (HW-73155)
containers for, 17: 7592(P)
deformation of corrugated, 17: 7543 (HW-70501)
design analysis of power extraction, 17: 7537 (DC-61-4-37)
development, 17: 7565(R) (PWAC-161)
development and testing of plutonium, 17: 7547(R) (HW-74761(p.3.1-39))
development for SNAP-2, 17: 6559
development of, for heavy water power reactors, 17: 7597(R) (DP-785)
development of low-enrichment superheater, 17: 7595(R) (ACNP-62018)
end cap temperature calculation of, 17: 7572 (TRG-Report-306)
fabrication of swaged uranium dioxide, 17: 6601(T,R) (EURAEC-372)
failure of, design of monitoring system for detecting, 17: 7583
heat transfer between coating and core of, 17: 6237
processing of irradiated, development of ion exchange process for, 17: 7550(R) (HW-74761(p.6.1-20))
radiation effects on prototype for PRTR, 17: 6744 (HW-SA-2668)
radiation effects on PuO_2–UO_2, for PRTR, 17: 6745 (HW-SA-2675)
sorting of, by gamma counting, 17: 7573 (UCRL-6621)
temperature distributions in, 17: 7565(R) (PWAC-161)
testing of, equipment for, 17: 7583
thermal cycling effects on, 17: 6513 (GEAP-4069)
REACTOR FUEL ELEMENTS (CERAMIC)
development, 17: 6536(T,R) (EURAEC-365)
production of coated uranium- and thorium-carbide particles, testing methods for, 17: 7577
testing of, by irradiation, 17: 7548(R) (HW-74761(p.4.1-47))
welding of internally cooled, by electron beam techniques, 17: 7548(R) (HW-74761(p.4.1-47))
REACTOR FUEL PLATES
development of aluminum coated fiberglas, 17: 6530 (TID-16847)
REACTOR FUEL RODS
corrosion of aluminum-clad uranium, in Canada-India Reactor, 17: 6587
development of PuO_2–UO_2, 17: 7544 (HW-71232)
dimensional change of, effects on helical wire wrappings, 17: 6743 (HW-SA-2445)
radiation effects, 17: 6739 (CVNA-153)
REACTOR FUEL SPHERES
thermal load limits of heterogeneous and homogeneous graphite, 17: 7576
REACTOR FUELS
analysis of, by radiometric methods, 17: 6473
burnup effects on ceramic, in pressurized hot water, 17: 6755
coating of particulate, properties of metal oxides and pyrolytic carbon for, 17: 6511(R) (BMI-1593(Del.))
corrosive effects of fused-salt, on reactor materials, 17: 7565(R) (PWAC-161)
depletion analysis, computer program for, 17: 7540 (GA-2749)
development of Phoenix, analysis of poison standards by neutron activation for tests in, 17: 5951 (HW-74796)
dissolution of, development of dissolver alloys for, 17: 6566

(HW-SA-2307)
encapsulation of plutonium-bearing, 17: 6523(R) (NUMEC-P-51)
fission product containment after release from, 17: 6311 (HW-SA-2843)
processing of irradiated thorium–uranium, 17: 6186 (ORNL-TM-420)
processing of irradiated, development of methods for, 17: 6192(T,R) (EURAEC-382)
processing plants in Western Europe for, 17: 6199
radiation effects testing, 17: 7584
radiation effects on coated particulate, 17: 6511(R) (BMI-1593(Del.))
radiation effects on uranium(IV) oxide–zirconium oxide, 17: 6752 (WAPD-264)
radiation effects on phase changes in uranium (IV) oxide–zirconium oxide, 17: 6753 (WAPD-T-1402)
uses of Phoenix, in other than compact reactors, 17: 7551(R) (HW-74761 (p.7.1-28))

REACTOR FUELS (FUSED SALTS)
chemistry, 17: 7606(R) (ORNL-1515)
corrosive effects of fluoride, on reactor materials, 17: 7606(R) (ORNL-1515)
heat transfer properties of fluoride, 17: 7606(R) (ORNL-1515)
processing, 17: 7606(R) (ORNL-1515)

REACTOR MATERIALS
brazing and welding developments for, 17: 7606(R) (ORNL-1515)
corrosion, 17: 6572 (OTS-61-31480)
corrosion by liquid metals and alloys, 17: 7606(R) (ORNL-1515)
corrosion of, conference on, 17: 6583
corrosion of, in high-temperature water cooled reactors, 17: 6567 (HW-SA-2745)
development and testing, 17: 7546(R) (HW-74761)
fabrication developments for, 17: 7606(R) (ORNL-1515)
radiation effects on non-metallic, 17: 6750 (TID-17382)
stress wave propagation in, 17: 7532(R) (ARF-K6018-3)
testing, 17: 6248(T,R) (EURAEC-393)
thermodynamics of, symposium on, 17: 6104
welding, 17: 6248(T,R) (EURAEC-393)

REACTOR MATRICES
buckling in deuterium-moderated uranium, 17: 7597(R) (DP-785)
critical masses of beryllium-oxide-reflected, cruciform, and square, 17: 7559 (JUL-76-RE)
development of light water-plutonium, 17: 7558 (HW-SA-2529)
neutron effective resonance integrals in, calculation of, 17: 7054 (AEEW-R-118)
neutron multiplication in beryllium oxide–uranium, 17: 7131 (NP-12330 (p.392-8))
nuclear properties of aluminum-clad enriched uranium dioxide in heavy water–water moderators, 17: 7627(R) (BAW-1262)
reactivity of beryllium-oxide-moderated slightly enriched uranium oxide, studies using pulsed neutron source, 17: 7535 (CEA-2201)

REACTOR MODERATORS
assembly of, with anisotropic expansion, 17: 6632(P)
temperature coefficients in zirconium hydride, 17: 7560 (NAA-SR-7140)

REACTOR SAFETY
containment in, air-tightness, 17: 6210
in BONUS reactor design, 17: 7625
practices for post-startup, 17: 7628 (TID-15677)
standards for, development for design and operation activities, 17: 7557 (HW-SA-2507)

REACTOR SHIELDING
requirements for beam tubes, 17: 7503
weight estimation of, for circulating fuel reflector-moderated ANP reactor, 17: 7564 (PWAC-89)

REACTOR SIMULATORS
development for analysis of low-enrichment superheater fuel elements, 17: 7595(R) (ACNP-62018)
use for analysis of boiling effects in water-moderated reactors, 17: 7574 (WAPD-T-1225)

REACTOR TUBES
design and development of, for nuclear superheat program, 17: 7601(R) (GNEC-254)
performance of Zircaloy-2, 17: 7552(R) (HW-74761(p.8.1-15))

REACTORS
application to space propulsion systems, 17: 6543
atmospheric radioactivity from, measurement of, 17: 6290
construction in Germany, 17: 7582
containment structure behavior, 17: 7532(R) (ARF-K6018-3)
control rod theory for cylindrically symmetric homogenized, 17: 7581
corrosion of, by decontaminating solutions, 17: 6588
development and construction in FORATOM countries, review, 17: 7579
loading device for fuel elements in, 17: 7589(P)
loading device for, 17: 7594(P)
loading device for fuel elements in, 17: 7590(P)
materials requirements, for thermionic conversion, 17: 6553
neutron chain reactions in, statistical theory of, 17: 7059
neutron chain reactions in, statistical theory of, 17: 7060
neutron chain reactors in, statistical theory of, 17: 7061
neutron flux distribution in, computer program for analysis of effects of control-rod withdrawal and fuel depletion on, 17: 7540 (GA-2749)
neutron flux flattening by variation of resonance escape probability in, 17: 7533 (BNL-5412)
neutron flux fluctuations in, method for analyzing, 17: 7638
neutron flux measurements in zero-energy, instruments for, 17: 6483
neutron flux measurements in, neutron thermopile for, 17: 6485
shielding, stresses in prestressed concrete, 17: 7500
time-to-poison extension in, by pre-shutdown power alterations, 17: 7536 (CRIO-1115)
transfer functions for spatial dynamics, 17: 7531 (AEEW-R-197)

RECTIFIERS
circuit analysis for voltage doubler, 17: 6400 (MATT-110)

REFLECTOR MODERATED REACTORS
design of circulating-fuel, 17: 7568 (PWAC-189(Vol.I))
design of circulating-fuel, 17: 7569 (PWAC-189(Vol.2))

REFRACTORY MATERIALS
bibliography, 17: 6518 (NP-12288)
bibliography on, 17: 6521 (NP-12417)
corrosion, 17: 6572 (OTS-61-31480)
corrosion by liquid alkali metals, 17: 6557
fabrication and properties of rolled sheet, 17: 6597(R) (DMIC-176)
joining of metals for space applications, 17: 6558
mechanical properties, 17: 6517 (MAB-188-M)
properties, 17: 6520(R) (NP-12373)
radiation effects on, 17: 6768
sealing of, to dielectrics, 17: 6676(R) (RADC-TDR-62-401)
sheet rolling of, 17: 6517 (MAB-188-M)
thermodynamic properties, 17: 6045(R) (RAD-SR-62-251)

REMOTE-CONTROL EQUIPMENT
design of electric cable system for assembly by, 17: 6208 (XDC-61-3-66)
irradiation of spheroids using, 17: 6224(P)

RENÉ-41
broaching, 17: 6622
broaching of turbine wheels, 17: 6623
drilling, 17: 6615
drilling of hardened, 17: 6616
end milling of hardened, 17: 6613
grinding of flat part, hold-down fixture for, 17: 6626
machining, 17: 6611
milling, 17: 6612

RESEARCH REACTORS
bacterial growth in cooling water in Canada-India, 17: 6587
characteristics of pulsed, review, 17: 7639
control and cooling system testing for Japanese Research Reactor-2, 17: 7631 (JAERI-1023)
corrosion of aluminum-clad uranium fuel rods in Canada-India, 17: 6587
critical mass determinations for various core arrangements in FRI-1 Merlin, 17: 7559 (JUL-76-RE)
design description of ASTRA and TRIGA Mark II, 17: 7578
isotope production and use, 17: 6171
loading of irradiation samples in Harwell, 17: 6370
neutron activation analysis with Triga, 17: 6028
neutron flux distribution in FRI-1 Merlin, 17: 7634 (JUL-75-RE)
neutron flux fluctuations in Ulysse, 17: 7638
neutron pulses from, activation analysis with, 17: 6026
production of short-lived isotopes in, 17: 6169
radiation dose rates at water surface in tank of Merlin, 17: 7633 (JUL-73-RE)

radioisotope production facilities in VVR-M, 17: 6170
shielding calculations for Merlin, 17: 7632 (JUL-67-RE)
startup of Belorussian IRT-2000, 17: 7637(T) (IPRS-15345)
types and uses in Western Europe, 17: 7640
use, 17: 7635 (TID-15608)
RESISTANCE FURNACES
description, for studies of mechanical properties at temperatures up to 2100°C, 17: 6212
operation of, for heat treatment of alloys, 17: 6652(R) (DRI-2057)
RETICULO-ENDOTHELIAL SYSTEM
antigen-antibody response, tracer study, 17: 5724
RHENIUM
adsorption of cesium ions on, 17: 6803 (UCRL-6389)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
RHENIUM ISOTOPES Re-186
beta-gamma directional correlations in, 17: 7218
RHENIUM ISOTOPES Re-188
beta-gamma directional correlation in, 17: 7223
RHODIUM
determination in plutonium–uranium–fissium alloys, spectrophotometric, 17: 5985
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
heat of sublimation and vaporization of solid, 17: 6093
separation from plutonium–uranium–fissium alloys by anion exchange, 17: 5985
RHODIUM ALLOYS
Nb–Rh, phase studies, 17: 6668(R) (NMI-9246)
RHODIUM CHLORIDES
identification, 17: 6036(R) (GA-1536)
RHODIUM COMPLEXES
radiation chemistry of, in acetylacetone, 17: 7133 (NP-12330(p.407-14))
RHODIUM ISOTOPES Rh-102
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
RHODIUM ISOTOPES Rh-104
energy levels, 17: 7227
gamma decay scheme of the 4.4-min metastable isomer of, 17: 7226
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
RIBONUCLEASE
proton exchange with heavy water, nuclear magnetic resonance spectra of, 17: 6073
RIBONUCLEIC ACID
molecular properties and thermostability in thermophilic microörganisms, 17: 6792(R) (ISS 62/14)
preparation by Weiss system using phage α purified DNA as primer, 17: 6792(R) (ISS 62/14)
RIBONUCLEIC ACID, DESOXY-
effects of ultraviolet radiation on, reaction mechanisms, 17: 5894
extraction from tissues, aqueous-phenol system, 17: 5675(R) (LAMS-2780(p.246-317))
metabolism during spermatogenesis, tracer study, 17: 5720
molecular structure in bacteriophage α, 17: 6792(R) (ISS 62/14)
radioinduced denaturation of, reaction mechanisms of, 17: 5855
radiosensitivity of synthesis in spleen lymphocytes, 17: 5830
RIBONUCLEOTIDES
radioinduced polymerization of, gamma, 17: 5791
RIBOSE
molecular properties and thermostability in thermophilic microörganisms, 17: 6792(R) (ISS 62/14)
ROCKET MOTORS
steel usage in cases for, 17: 6651 (DMIC-178)
ROCKET REACTORS
development of advanced, 17: 7538(R) (DCAS-TDR-62-44)
performance of, effects of thermal radiation on, 17: 7645
ROCKET REACTORS (KIWI)
materials requirements for, 17: 6547
ROCKET REACTORS (TORY)
fuel element sorting by gamma counting, 17: 7573 (UCRL-6621)
materials, performance in, 17: 6546
ROCKETS
electron-bombardment ion, operation with alternating currents, 17: 7644 (NASA-TN-D-1457)
nuclear powered, development of, 17: 7645
ROCKS
analysis for rare earths, spectrographic, 17: 6008
argon isotope content of, bibliography on, 17: 6270(R) (NYO-10325)
calcium isotope content of, bibliography on, 17: 6270(R) (NYO-10325)
elastic properties of, in Nevada Spring Hill formation, 17: 6275 (UCRL-6477)
radioactivity of, in Lamalou and Bedarieux, 17: 6281
strontium isotope content of, bibliography on, 17: 6270(R) (NYO-10325)
ROLLING
techniques for refractory materials, 17: 6597(R) (DMIC-176)
RUBBER
curing of balls of, using radiation, 17: 6224(P)
RUBIDIUM
determination in rubidium-doped, thalliated, sodium iodide scintillation crystal using sodium tetraphenylboron, 17: 5989
electric and physical properties of, at high temperatures, 17: 6635(R) (AGN-8069)
separation from cesium by solvent extraction using nitrobenzene, mechanism of, 17: 6194
RUBIDIUM ISOTOPES Rb-86
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
RUBIDIUM ISOTOPES Rb-87
abundance in continental soil, 17: 6291
RUBIDIUM NITRATES
transport number of cation in fused, 17: 6080
RUTHENIUM
analysis for osmium using diantipyrinylpropylmethane, photometric, 17: 6014
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
isotope effect in superconducting, 17: 6872
separation from fuel processing solutions by ion exchange, 17: 5656(R) (KR-29)
RUTHENIUM ALLOYS
Nb–Ru, phase studies, 17: 6668(R) (NMI-9246)
RUTHENIUM CHLORIDES
dissociation and thermodynamic properties of, 17: 6036(R) (GA-1536)
spectra of gaseous, infrared, 17: 6036(R) (GA-1536)
RUTHENIUM ISOTOPES
abundance in iron meteorites, 17: 6289
RUTHENIUM ISOTOPES Ru-106
metabolism in dogs, 17: 5670(R) (LAMS-2780(p.17-84))
RUTHENIUM NITROSYLS
complex formation in hydrochloric acid, 17: 6051 (TID-15360)

S

SAFETY
assessment of radiation hazards, 17: 6330
SALICYLALDEHYDE
triethylene tetramine cobalt chloride, radiation damage annealing in, 17: 7135 (NP-12330(p.422-8))
SALIVARY GLANDS
radiation effects on masculinization of submaxillary, in rats, 17: 5800
SAMARIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
determination in thorium by spectral analysis, 17: 6021
separation from neodymium by displacement chromatography, band distribution in, 17: 6004
separation from rare earths, 17: 6019
spectra of, effect of transitions in 4f shell on absorption, 17: 6099
SAMARIUM CHELATES
with 2-hydroxybenzophenone, emission spectra, 17: 6085
SAMARIUM HYDRIDES
mass spectra of volatile, 17: 6791 (IS-424)
SAMARIUM ISOTOPES
alpha decay systematics for, 17: 7199
SAMARIUM ISOTOPES Sm-143

isomeric transition in, 17: 7237
SAMARIUM ISOTOPES Sm-144
neutron reactions (n,2n), cross section for, 17: 7237
SAMARIUM ISOTOPES Sm-147
alpha decay scheme of, 17: 7150
SAMARIUM ISOTOPES Sm-148
energy levels from europium-148 and promethium-148 decays, 17: 7181
SAMARIUM ISOTOPES Sm-150
neutron capture by, spectra from, 17: 7273
SAMARIUM ISOTOPES Sm-152
decay of, E2 and K conversion coefficients in, 17: 7203
internal conversion coefficients of 2^+–0^+ E2 transitions of, 17: 7079 (IS-272)
scattering resonances in, interference between, 17: 7109 (NP-12330 (p.147-51))
SAMARIUM ISOTOPES Sm-154
energy levels with spin and parity 4^+ and 6^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
SAMARIUM OXYTELLURIDES
preparation and properties, and crystalline structure, 17: 6068
SAMPLING
equipment design for stream water, 17: 6398 (KY-423)
graphite from reactors, apparatus for, 17: 7593(P)
materials for airborne iodine isotope, 17: 5754 (PG-Report-408)
SANDS
beta activity measurement from, 17: 5972 (PG-Report-403)
SAPPHIRES
sealing of synthetic, to refractory metals, 17: 6676(R) (RADC-TDR-62-401)
SARCOMAS
development in rats, effects of whole-body x irradiation on, 17: 5860
SATELLITES
electron spectra observations by Discoverers 29 and 31, 17: 6917 (UCRL-6792-T)
origin of the planetary, 17: 6908
propulsion of stationary, ion systems for, 17: 7648
SAVANNAH RIVER COMPONENTS TEST REACTOR
development and operation of, 17: 7609(R) (SRO-75)
operation, 17: 7597(R) (DP-785)
SCANDIUM
book: *Scandium: Its Geochemistry and Mineralogy*, 17: 6301
determination in soil and rocks, 17: 6019
determination using chlorphosphonazo III, photometric, 17: 6016
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
separation from beryllium, cassiterite, and tungstate, 17: 6019
SCANDIUM COMPLEXES
spectra of organophosphorus-trifluorothenoyl acetone, infrared, 17: 6050 (TID-15323)
with arsenazo III, formation mechanism of, 17: 6007
SCANDIUM ISOTOPES Sc-44
nuclear spins and hyperfine structure, 17: 7137 (PUC-1962-59)
SCANDIUM ISOTOPES Sc-45
proton reactions (p,n), cross section relations with energy, 17: 7144 (TID-17357(Pt.III))
SCANDIUM ISOTOPES Sc-46
gamma emission of, 17: 7116 (NP-12330(p.186-92))
SCANDIUM MINERALS
book: *Scandium: Its Geochemistry and Mineralogy*, 17: 6301
SCANDIUM PERCHLORATES
reactions with chromium(III)–neptunium(V) complex in perchloric acid, spectra of, 17: 6074
SCATTERING
amplitude attenuation in, 17: 6894
amplitude of, expansion in relativistic spherical functions, 17: 7521
amplitudes, Born series of non-relativistic elastic, 17: 6973
amplitudes in, Bohr approximation calculations of, 17: 7184
amplitudes in complex angular momentum plane, 17: 6974
amplitudes of, parametric representations of, 17: 6965
analytic approximation to the low-energy solutions of inverse amplitude dispersion relations, 17: 7510
application of Regge poles to high-energy inelastic, 17: 7513
book: *Quantum Theory of Scattering*, 17: 7053
dispersion relations in, 17: 7010
dispersion-theoretic impulse approximation for potential, 17: 7512
elastic, high-energy behavior of amplitudes in, 17: 7003
in K = 0 band of odd-odd deformed nuclei, 17: 7146 (UCRL-9764)
inelastic diffraction processes at high energies, 17: 7522
interference between Raleigh and resonance, 17: 7109 (NP-12330(p.147-51))
multiple, in the presence of energy losses, 17: 6954 (NP-12259)
potential, derivation of fundamental relations for, 17: 7506
Regge poles and Landau singularities in, 17: 7526
relation between binding energy and coupling constant in, 17: 6943 (BNL-5517)
role of short-range three-particle forces in processes with the generation of three particles near threshold, 17: 7518
surface divergences in the Bogolyubov method, 17: 7516
theory of, moving-pole, 17: 7004
theory of relativistic Coulomb, 17: 7520
three-body problem for short-range forces in the linear approximation in the force range, 17: 7517
threshold effects in average cross sections according to R-matrix theory, 17: 7236
variational calculations for nonrelativistic elastic, 17: 7507
SCINTILLATION
processes in, theory of, 17: 6444(T) (AEC-tr-5259)
SCINTILLATION DETECTORS
design and development of, 17: 6132(R) (TID-17272)
design and performance of thallium-activated sodium iodide, for neutrons, 17: 6474
design for fast neutrons, 17: 6381 (AD-254402)
design of, for analysis of fecal samples, 17: 5734
design of zinc sulfide, for detection and measurement of uranium-emitted alpha particles, 17: 6434 (HW-73155)
design of 4π plastic beta, 17: 6459
development and operation of, review of, 17: 6444(T) (AEC-tr-5259)
efficiency measurement in liquid, using external gamma sources, 17: 6454
support in thyroid radioiodine uptake studies, construction of trolley for, 17: 6213
use in calibration and standardization of gamma sources, 17: 6822
use of continuous-flow column, for beta emitters in solution, 17: 6446
SEA URCHINS
radioinduced cleavage delay in gametes in *Arbacia punctulata*, recovery from, 17: 5895
SEALS AND GLANDS
development for liquid metal cooled reactors, 17: 7606(R) (ORNL-1515)
development of rotating-shaft and valve-stem, for liquid metals, 17: 7606(R) (ORNL-1515)
fabrication of pump, by hot pressing, 17: 7606(R) (ORNL-1515)
SEIGNETTOELECTRIC MATERIALS
frequency modulation in cyclotrons with, 17: 7413
neutron-diffraction analysis of, 17: 6647 (BNL-5747)
polarization and Curie temperature of, effects of crystal structure ore, 17: 6678 (TID-14508)
SEISMOLOGY
of AARDVARK shot, 17: 6267 (NP-12328)
of DANNY BOY shot, 17: 6268 (NP-12419)
of Hyrax event, 17: 6269 (NP-12420)
underground nuclear explosion detection using, 17: 6265 (NP-12297)
VELA-UNIFORM program, measurement of signals from Fisher detonation in, 17: 6259 (NP-12279)
VELA-UNIFORM program, measurement of signals from Small Boy in, 17: 6260 (NP-12280)
VELA-UNIFORM program, measurement of signals from Sedan shot in, 17: 6261 (NP-12281)
VELA-UNIFORM program, measurements of signals from Merrimac shot in, 17: 6262 (NP-12282)
VELA-UNIFORM program, measurements of signals from Agouti in, 17: 6263 (NP-12283)
VELA-UNIFORM program, measurement of signals from Antler shot in, 17: 6264 (NP-12284)
VELA-UNIFORM program, measurement of signals from Chinchilla shot

in, 17: 6266 (NP-12298)
SELENIOUS ACID
solvent properties for niobium and zirconium, 17: 6022
SELENIUM
separation by solvent extraction, 17: 6132(R) (TID-17272)
separation of, radiochemical procedure for, 17: 6132(R) (TID-17272)
SELENIUM ISOTOPES Se-81
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
SEMICONDUCTOR DETECTORS
design and performance of thin, 17: 6440 (UCRL-10030)
design and performance of helium-3-filled, for fast neutron spectra, 17: 6481
efficiency for alpha particles, 17: 7119 (NP-12330(p.202-8))
performance of p-n junction, for x-ray spectrometry, 17: 6458
SEMICONDUCTORS
operation and response of solar energy converters, 17: 6552
plasma instabilities in, review, 17: 7490
radiation effects on catalytic properties of, 17: 6738 (ASD-TDR-62-233)
SEPARATION PROCESSES
development of equilibrium density gradient sedimentation method for labeled and unlabeled enzymes, 17: 5710
SERINE
analysis for carbon-14 by continuous scintillation counting, 17: 5709
SHEEP
gastrointestinal absorption of magnesium, tracer study, 17: 5737
strontium-90 distribution in bones, 17: 5741
thyroid tumors induced by chronic ingestion of iodine-131, 17: 5768 (HW-SA-2493)
SHEETS
development of refractory alloy, 17: 6517 (MAB-188-M)
rolling techniques for refractory materials, 17: 6597(R) (DMIC-176)
SHELLS
design of minimum-weight closure heads for pressure vessels, 17: 6211
radiation effects on strength of, 17: 6754(T) (FTD-TT-62-719)
stress analysis in axisymmetric thin, computer program for, 17: 6507
SHELTERS
design and cost factors for, to accommodate 100 persons for 14 days, 17: 6324 (USNRDL-TR-582)
design for cast-in-place concrete, 17: 6313 (NP-12349)
evaluation of kill probability in basement and underground family, in target area, 17: 6345
survey of fallout, comparison of aerial photographic and documentary methods, 17: 6302 (AD-276119)
SHIELDED CONTAINERS
design, 17: 6244 (HW-SA-2807)
design of impact-resistant, for fission products, 17: 6362
impact testing, 17: 6244 (HW-SA-2807)
SHIELDING
design considerations for 500-Mev to 1-Bev linear accelerator, 17: 7318 (BNL-6511(p.110-23))
design of zinc bromide filled windows for, 17: 7498 (USNRDL-TR-594)
for dental installations, 17: 6344
for radiation detectors, 17: 6486(P)
heat production in concrete pressure vessel, 17: 7500
methods and principles of, 17: 7499
production of steel doors, 17: 7504
requirements for accelerator facility, 17: 7393
requirements for isochronous cyclotrons, 17: 7395
requirements for large isochronous cyclotron, 17: 7396
requirements for LRL 184-inch cyclotron, 17: 7401
SHIELDING MATERIALS
activities induced in cyclotron, 17: 7395
attenuation of gamma radiation by, 17: 7502
for professional office buildings, efficiencies of, 17: 6720
gamma attenuation factors for, 17: 7501
requirements for reactor beam tubes, 17: 7503
SHIPPING
containers for, of fission products, 17: 6362
SHIPPINGPORT PRESSURIZED WATER REACTOR
development and operation, 17: 7614(R) (WAPD-MRP-100)
materials development and selection for, review of, 17: 7615 (WAPD-T-1545)
SHOCK TUBES
evaluation for use in studies on dynamically loaded underground structures, 17: 5666 (AD-274294)
precursor afterglow ionization in hydromagnetic, 17: 7422 (AWRE-O-11/62)
SHOCK WAVES
boundary layers and sheath potentials in, in air, 17: 6899
effect of topography on, in air, 17: 6276 (WT-502)
ionization rate behind, in air, 17: 6773 (AFCRL-62-751)
magnetohydrodynamically supported hypersonic, 17: 6783 (BSD-TDR-62-337)
mitigation of effects by lightweight vermiculite concrete, 17: 5668 (DASA-1263)
plasma production in air by, 17: 7491
properties of strong cylindrical, 17: 6844
structure of magnetohydrodynamic, in dense media, 17: 6901
SILANES
methyltrivinyl-, frequency sweep double resonance spectra of, 17: 6076
SILICIDE COATINGS
development of, for niobium–titanium–vanadium alloys, 17: 6562(R) (ARF-B-6001-1)
SILICON
nitrogen nucleus reactions at 27.5 Mev, 17: 7252
SILICON CARBIDES
SiC–SiO_2, endurance of aluminum phosphate-bonded coating of, 17: 6675(R) (PWA-2128)
SiC–SiO_2, total hemispherical emittance at high temperatures, 17: 6731
SILICON COATINGS
Cr–Si–Ti, for niobium alloys, 17: 6510 (ASD-TDR-62-934)
SILICON CRYSTALS
radiation defects in, deep levels of, 17: 6767(T)
radiation effects on, proton, 17: 6759
x-ray transmission in perfect, abnormal aspects of, 17: 6063
x-ray transmission by imperfect, 17: 6064
SILICON FLUORIDES
thermodynamic properties of, from 15°K to triple point, 17: 6056 (WRU-202)
SILICON HYDRIDES
mass spectra of volatile, 17: 6791 (IS-424)
SILICON ISOTOPES Si-28
deuteron reactions (d,p) at 13.8 Mev, proton polarization from, 17: 7286
energy levels, 17: 7262
SILICON ISOTOPES Si-29
gamma reactions (γ,π^-), cross sections for, 17: 6975
SILICON ISOTOPES Si-30
energy levels, 17: 7104 (NP-12330(p.119-21))
proton reactions (p,γ), polarization of gamma rays from, 17: 7278
SILICON JUNCTIONS
performance as x-ray spectrometer, 17: 6458
use of p-type, in transmission counters for nuclear particle detection, 17: 6440 (UCRL-10030)
SILICON OXIDES
properties and structure of colloidal, 17: 6648 (CEA-2129)
radioinduced reaction with acrylic acid or styrene for preparation of ion-exchange sorbent, 17: 6140
sealing of fused, to metals, 17: 6676(R) (RADC-TDR-62-401)
CaO–La_2O_3–SiO_2, phase studies, 17: 6101
Cr_2O_3–NiO–SiO_2, endurance of aluminum phosphate-bonded coating of, 17: 6675(R) (PWA-2128)
SiC–SiO_2, endurance of aluminum phosphate-bonded coating of, 17: 6675(R) (PWA-2128)
SiC–SiO_2, total hemispherical emittance at high temperatures, 17: 6731
SILICON SYSTEMS
Al–Si, activation analysis for phosphorus in hypereutectic, 17: 5994
Al–Si–Zr, phase studies, 17: 6729
O–Si–Ti–W–Zr, oxidation resistance of, testing as tungsten coating, 17: 6519(R) (NP-12293)
SILICONES
curing of, by irradiation, 17: 6769(P)
SILTS
beta activity measurement from, 17: 5972 (PG-Report-403)
SILVER

critical constants and temperature range of liquid, 17: 6711
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
fission of, by protons at 600 Mev, 17: 7086 (NP-12319)
ion ranges in, determination from collection experiments, 17: 6820
photoelectron distribution from, cesium-137 gamma, 17: 6833
radiation effects on electric resistance of, 17: 6732 (62-GC-207)

SILVER ALLOYS
Al–Ag, dilocation reactions in intermediate precipitates of, 17: 6687 (UCRL-10124)
Al–Ag, yield strength of intermetallic, temperature effects on, 17: 6685 (UCRL-9992)
Bi–Ag, coprecipitation of radioactive tracers in, 17: 6683 (UCRL-6452 (Pt.II))

SILVER CHLORIDE CRYSTALS
properties as nuclear disintegration detector, 17: 7261

SILVER CHLORIDES
electronic properties of, design of device for determining, 17: 6792(R) (ISS 62/14)
valence band structure, 17: 6053 (TID-17447)

SILVER HALIDES
radiation monitoring using emulsions of, 17: 6487(P)

SILVER ISOTOPES
precipitation in bismuth alloys, 17: 6683 (UCRL-6452(Pt.II))

SILVER ISOTOPES Ag-107
neutron reactions (n,γ), measurement of γγ coincidences in, 17: 7285
proton reactions at 57 Mev on, proton distributions from, 17: 7197

SILVER ISOTOPES Ag-108
energy levels, 17: 7285

SILVER ISOTOPES Ag-109
proton reactions at 57 Mev on, proton distributions from, 17: 7197

SILVER ISOTOPES Ag-110
isomeric-pair production by neutron activation, yield ratios of, 17: 7248

SILVER SALTS
protective effects against iodine-131 toxicity in animals, 17: 6005

SIOUX FALLS POWER REACTOR
development, April to June 1962, 17: 7595(R) (ACNP-62018)

SKELETON
strontium movement in human, 17: 5712

SKIN
effects of inflammation on uptake of gold-198 colloids, 17: 5679
protection from radiation by percental opening in sieve irradiation, 17: 5898
radiation effects on guinea pig, protective effects of cortisone against, 17: 5915
radiation effects on fatty acid composition of lipids, 17: 5825
radiation effects on receptor apparatus of, in man, 17: 5851
radiosensitivity, 17: 5813

SKIN DISEASES
radiation sorption by psoriatic parakeratotic stratum corneum, 17: 5689

SLURRIES
heat and mass transfer in, 17: 6232

SNAPPER OPERATION
shock waves in, effect of topography on, 17: 6276 (WT-502)

SODIUM
analysis and sampling of, procedures for, 17: 7563(R) (PRDC-TR-59)
analysis for carbon, 17: 5948 (AWRE-O-62/62)
concentration in cellular fluids, 17: 5694
corrosive effects of liquid, on beryllium, 17: 7565(R) (PWAC-161)
corrosive effects of liquid, on reactor materials, 17: 7606(R) (ORNL-1515)
corrosive effects on beryllium oxide, 17: 7606(R) (ORNL-1515)
excretion in man, effects of dietary potassium levels, 17: 5713
mass transfer in system of liquid, with stainless steel, 17: 6575(R) (TID-17384)
mass transfer in system of liquid, with stainless steel, 17: 6576(R) (TID-17386)
neutron activation in phantoms, fast, 17: 5736
separation from cesium by solvent extraction using nitrobenzene, mechanism of, 17: 6194
spectrum of, vibrational, 17: 7132 (NP-12330(p.399-406))

SODIUM ACETATES
transfer between heavy and light water, ionic hydration in, 17: 6096

SODIUM ACETYLIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)

SODIUM ALLOYS
K–Na, corrosive effects on reactor materials, 17: 7565(R) (PWAC-161)
K–Na, corrosive effects on beryllium oxide, 17: 7606(R) (ORNL-1515)
K–Na, distillation, 17: 7606(R) (ORNL-1515)
Pb–Na, corrosive effects on Inconel and stainless steel, 17: 7606(R) (ORNL-1515)

SODIUM CHLORIDE CRYSTALS
electron emission from, effects of positive-ion bombardment on exo-, 17: 6831

SODIUM CHLORIDES
transfer between heavy and light water, ionic hydration in, 17: 6096
$NaCl–UCl_4$, petrology, 17: 7606(R) (ORNL-1515)

SODIUM COMPLEXES
with uranyl acetate in aqueous solution, spectra of, 17: 6081

SODIUM FLUORIDES
freezing point depressions by tetravalent fluoride solutes, 17: 6088
transfer between heavy and light water, ionic hydration in, 17: 6096
$LiF–NaF–ZrF_4$, corrosive effects of liquid, on nickel and nickel alloys, 17: 6571 (ORNL-TM-411)
$NaF–UF_4–ZrF_4$, phase studies, 17: 7606(R) (ORNL-1515)
$NaF–UF_4–ZrF_4$, thermal capacity at 550 to 850°C, 17: 7606(R) (ORNL-1515)

SODIUM HYDROXIDES
corrosive effects on nickel, 17: 7606(R) (ORNL-1515)
polarography of, using teflon dropping mercury electrode, 17: 5987
thermal conductivity at 650 to 1000°F, 17: 7606(R) (ORNL-1515)
viscosity at 340 to 448°C, 17: 7606(R) (ORNL-1515)

SODIUM IODIDE CRYSTALS
analysis for rubidium in rubidium-doped, thalliated, using sodium tetraphenylboron, 17: 5989
coating for, reflective, 17: 6491(P)
preparation and properties of thallium activated, 17: 7121 (NP-12330 (p.214-19))

SODIUM IODIDES
decomposition of stored solutions containing iodine-131, 17: 5693

SODIUM ISOTOPES Na-21
energy levels from deuteron reactions (d,n) in neon, 17: 7170
energy levels of, measurement of first excited, 17: 7171

SODIUM ISOTOPES Na-23
electron magnetic elastic scattering at 41.5 Mev, 17: 7222
energy levels from deuteron reactions (d,n) in neon, 17: 7170
nuclear quadrupole coupling in borates, 17: 7127 (NP-12330(p.295-301))

SODIUM ISOTOPES Na-24
accumulation in aquatic insects, 17: 5702 (HW-SA-2848)
beta activity of, design of 4π beta plastic scintillator for measurement of, 17: 6459
determination in blood by gamma spectrometry, 17: 5968 (PG-Report-385)
determination of levels in man after accidental neutron exposure, 17: 5775 (TID-14529)
gamma specific emission coefficient, 17: 6431 (CEA-2036)
measurement of steam-water specific gravity in boiler, 17: 6378
production and use of, 17: 6171
recoil and range in aluminum during high-energy proton bombardment, 17: 7230
tracer applications in industry, 17: 6372
tracer use in flow-rate and leak measurements, 17: 6376
tracer use in subterranean water flow measurements, 17: 6377
use in detection of irrigation water storage leaks, 17: 6371

SODIUM NITRATES
transfer between heavy and light water, ionic hydration in, 17: 6096
transport number of cation in fused, 17: 6080

SODIUM NITRITES
transport number of cation in fused, 17: 6080

SODIUM PHOSPHATES
$Na_4P_2O_7–Na_2SO_4$, polarographic analysis for uranium(IV), 17: 5990

SODIUM SALICYLATES
analytical use in titrimetric determination of beryllium, 17: 6011
SODIUM SULFATES
$Na_5P_3O_{10}$–Na_2SO_4, polarographic analysis for uranium(IV), 17: 5990
SODIUM SULFITES
therapeutic effects in radiation sickness, 17: 5927
SODIUM TUNGSTATES
electrical properties, 17: 6658 (IS-433)
SODIUM VANADYL VANADATES
thermoelectric properties of liquid, 17: 6633 (AD-274831)
SOILS
contamination by iodine isotopes from nuclear explosions, 17: 6322 (UCLA-499)
flow in, multidimensional partially saturated, 17: 6256 (HW-SA-2854)
gamma dose rate from neutron-induced activity in, 17: 6258 (NDL-TR-41)
permeability of, computational scheme for in-place measurement of, 17: 6790 (HW-SA-2405)
physical properties, 17: 5666 (AD-274294)
radioactivity of, hazards of natural, 17: 6341
radioactivity of USSR, 1958, 17: 6288
sampling of, in New Zealand, 17: 5750(R) (DXRL-F6)
SOLAR BATTERIES
development of graded-base radiation-resistant, 17: 6795(R) (NP-12317)
operation and response of solar energy converters, 17: 6552
SOLAR FLARES
ionization in F2 region, decay of, 17: 6933
particle flux in Sept. 28, 1961, 17: 6921
proton fluxes in, of July 1961, 17: 6920
SOLAR POWER
thermoelectric generator system design and testing, 17: 7642(R) (AD-276092)
SOLAR RADIATION
field of, capture of small absorbing particles by, 17: 6914
interaction with geomagnetic field, 17: 6913
SOLENOIDS
current-carrying capacity of niobium–zirconium, 17: 6209
radiation effects on niobium–zirconium, proton, 17: 6756
SOLIDS
electron emission after excitation, review on, 17: 6789 (ERDL-1704-RR)
electron energy relaxation in, theory of, 17: 6075
thermal conductivity of anisotropic, at high temperatures, 17: 6640 (ASD-TDR-62-608(Pt.I))
thermodynamic function calculation from dissociation-pressure data, 17: 6108
SOLVENT EXTRACTION PROCESSES
for inorganic species, review, 17: 6179 (IA-740)
mechanism of, using dialkylphosphoric acids in, 17: 6197
SOLVENTS
properties evaluation of organic, for inorganic salts, 17: 6190(T) (AEC-tr-5574)
SONIC INSPECTION
of welded steel plates, equipment for, 17: 6250(P)
of welds in thick wall steel pipe, 17: 6243 (HW-74597)
SOUND
absorption in helium II, theory of, 17: 6871
SOVIET UNION
atmospheric monitoring for natural radiation, 17: 6286
SPACE
antimatter in, 17: 6915(T)
cosmic radiation hazards in, 17: 6305 (BNL-6501)
model of interplanetary gas, 17: 6909
radiation effects on man in, 17: 5868
SPACE FLIGHT
environmental control and power in, biochemical fuel cells for, 17: 5663
propulsion requirements for interplanetary, 17: 7645
SPACE POWER UNIT REACTOR
development, 17: 7610(R) (SY-5396-R2)
SPACE VEHICLES
environmental control and power in, biochemical fuel cells for, 17: 5663
lubrication problems in, 17: 6548
materials for ion propulsion systems, 17: 6544
propulsion of, characteristics of ion sources for, 17: 6900
propulsion of, performance of a-c and d-c arc-jet systems for, 17: 7649
propulsion of, performance of crossed-field plasma accelerators for, 17: 7647
propulsion systems for, ion-beam-neutralizer performance in, 17: 7646
propulsion systems for deep-space missions, 17: 6543
propulsion systems for, materials for plasma, 17: 6545
pyrolytic materials for reentry, 17: 6550
thermal control surfaces in, 17: 6549
SPECTRA
atomic, effects of Coulomb interactions on energy distribution of terms and line arrays in, 17: 6798 (RM-2947-AEC)
SPECTRAL SHIFT CONTROL REACTOR
criticality studies of enriched lattices moderated by heavy water–water mixtures, 17: 7627(R) (BAW-1262)
design and characteristics, 17: 7580
SPECTROMETERS
design of nuclear magnetic resonance, using modulation, 17: 6421
design of velocity selector for subthermal charged particles, 17: 6466
focussing properties of field of form $r^{-3}\sin^{-3}\theta$ in, 17: 6414
magnet and timing controls for Compton, 17: 6438 (TID-15530)
SPECTROSCOPY
book: *Spectroscopy*, 17: 6023
use of fluorescent x rays produced by beta particles for, 17: 5982(T) (CEA-tr-X-461)
SPERM
radioinduced cleavage delay in *Arbacia punctulata*, recovery from, 17: 5895
SPERMATOGENESIS
desoxyribonucleic acid synthesis during, tracer study, 17: 5720
SPHERES
radiation effects on strength of hollow, 17: 6754(T) (FTD-TT-62-719)
SPHEROIDS
irradiation of, equipment for, 17: 6224(P)
SPINAL CORD
radiation effects on experimental encephalomyelitis in guinea pigs, 17: 5801
SPLEEN
homograft reactions, 17: 5762(R) (AD-276039)
protective effects in injectal fetal cells against radiation injuries in mice, 17: 5810
radiosensitivity of desoxyribonucleic acid synthesis in lymphocytes, 17: 5830
transplantation of fresh and preserved, in treatment of radiation sickness in rabbits, 17: 5926
SPUTTERING
of solids, review, 17: 6813(T) (NP-tr-930)
STAINLESS STEEL
brazing and welding of type 316, 17: 7606(R) (ORNL-1515)
corrosion, 17: 6572 (OTS-61-31480)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
corrosion of type 304, by lead (liquid) at high temperatures, 17: 7606(R) (ORNL-1515)
corrosion of types 304 and 430, by lead-sodium alloys at high temperatures, 17: 7606(R) (ORNL-1515)
corrosion of types 304 and 316, by lithium at 1000°C, 17: 7606(R) (ORNL-1515)
drilling of precipitation-hardening, 17: 6615
grinding of austenitic, effects of variables, 17: 6625
high-strength, bibliography on, 17: 6521 (NP-12417)
mass transfer in system of, with liquid sodium, 17: 6575(R) (TID-17384)
mass transfer in system of, with liquid sodium, 17: 6576(R) (TID-17386)
milling, 17: 6612
radiation effects on creep, 17: 7553(R) (HW-74761(p.9.1-37))
radiation effects on mechanical properties of type 347, at 1150 to 1700°F, 17: 7606(R) (ORNL-1515)
radiation effects on type 347, 17: 6511(R) (BMI-1593(Del.))
surface friction in sodium environments, 17: 6511(R) (BMI-1593(Del.))
tensile fatigue of type 305, 17: 6663 (MATT-154)
tensile properties, 17: 6661 (IPL-TR-32-222)
thermal conductivity, 17: 6673 (ORNL-2065)

thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Eu_2O_3–stainless steel, properties of cermets of, 17: 6664 (MND-M-2346)
STAINLESS STEEL COATINGS
for reactor fuel elements, high-temperature properties of, 17: 7571 (TID-17402)
STANDARDS
for reactor safety, 17: 7557 (HW-SA-2507)
STANFORD LINEAR ACCELERATOR
design and development of, status report on, 17: 7320 (BNL-6511 (p.128-61))
STARS
emission lines of carbon in HI regions of, forbidden, 17: 6903
energy transport in hydrogen ionization zone of giant, 17: 6904
excitation of atoms and ions by electron impact, 17: 6905
formation of, initial stage, 17: 6916
STATISTICS
application in analysis of late effects of radiation from atomic explosion on human populations, 17: 6332
applications in analysis of radiation effects on tumor incidence in populations of Hiroshima and Nagasaki, 17: 6333
regression methods applied in estimating fallout from a nuclear detonation, 17: 6306 (CDRP-182-105)
statistical behavior of linear systems, 17: 6891
transport properties of matter in, theory, 17: 6818
STEAM
steam–water, flow patterns of, two-phase, 17: 7613(R) (UNC-5042)
steam-water, specific gravity in boilers, 17: 6378
STEARIC ACID
adsorption by copper, gold, and iron films from hexadecane solution, 17: 6078
STEEL
analysis for molybdenum and tungsten, x-ray spectrochemical, 17: 5997
book: *Machining Difficult Alloys*, 17: 6608
broaching of high-strength, tool design for, 17: 6621
broaching of type 4340, 17: 6622
corrosion, 17: 6572 (OTS-61-31480)
corrosion by liquid alkali metals, 17: 6557
corrosion of, by water, 17: 5656(R) (KR-29)
drilling of high-strength, 17: 6615
engineering properties of Mar-Strained, 17: 6639 (ASD-TDR-62-230)
fracture of, biaxial brittle, 17: 6245 (NP-12374)
high-strength, bibliography on, 17: 6521 (NP-12417)
machining characteristics of high-strength 4130, 4330, and 4340, 17: 6609
mechanical properties of high-strength, 17: 6651 (DMIC-178)
milling of high-strength, 17: 6612
performance of high-speed tool, in end milling of U-500 alloy, 17: 6614
plating of, evaluation of, 17: 6534(T,R) (EURAEC-329)
plating of, evaluation of stainless, 17: 6537(T,R) (EURAEC-377)
production of shielding doors, 17: 7504
radiation effects, 17: 6735 (AE-90)
stresses in, plates clad with stainless steel, 17: 6586
temperature effects on mechanical properties of, cryogenic, 17: 6542
tensile properties of low-alloy, 17: 6661 (JPL-TR-32-222)
ultrasonic inspection of welds in thick wall pipe of, 17: 6243 (HW-74597)
ultrasonic testing of butt-welded, equipment for, 17: 6250(P)
uses of high-strength, for rocket-motor cases, 17: 6651 (DMIC-178)
welding of, electroslag vertical, 17: 6602(T,R) (EURAEC-392)
STELLARATORS
plasma instabilities in, 17: 7448
STEROIDS
protective effects of prednisolone against radioinduced injury to ureter, 17: 5820
STOMACH
iodine-131 content in, after intravenous injection for myocardial infarction detection, 17: 5685
STRAIN GAGES
circuitry of, and recording equipment for, 17: 6405 (SCTM-364-61(73))
STRANGE PARTICLES
decay of, existence of $\Delta S = -\Delta Q$ in, 17: 6996
photoproduction near the threshold, 17: 7051
resonant states of, 17: 7014
STRATOSPHERE
biological effects of radiation, 17: 5765 (AFCRL-62-244)
dosimetry of cosmic radiation, 17: 5765 (AFCRL-62-244)
meridional circulation in, during International Geophysical Year, 17: 6274 (TID-17467)
radioisotope levels in, 17: 5751(R) (HASL-132)
sampling of, for radioisotopes, 17: 6271(R) (NYO-10464)
STRESS ANALYSIS
in reactor materials, 17: 7532(R) (ARF-K6018-3)
of axisymmetric thin shells, computer program for, 17: 6507
STRONTIUM
bibliography on metabolism in animals and man, 17: 5747
bone metabolism, effects of dietary protein levels, 17: 5745
content in fetal body fluids, 17: 5731
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
effects on cardiac contraction, 17: 5686
levels of, in human bone, 17: 5751(R) (HASL-132)
movement in human skeleton, 17: 5712
separation from grass, milk, and water by amalgam exchange, 17: 6132(R) (TID-17272)
separation of, radiochemical procedure for, 17: 6132(R) (TID-17272)
sorption, retention, and urinary excretion of, in bottle- and breast-fed babies, 17: 5730
STRONTIUM CARBIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)
STRONTIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
STRONTIUM HYDROXIDES
thermal capacity at 570 to 900°C, 17: 7606(R) (ORNL-1515)
STRONTIUM ISOTOPES
occurrence of, in meteorites, minerals, and rocks; bibliography on, 17: 6270(R) (NYO-10325)
sorption by natural minerals, 17: 7653(R) (ORNL-TM-396)
STRONTIUM ISOTOPES Sr-85
metabolism in man, 17: 5670(R) (LAMS-2780(p.17-84))
metabolism in mice, effects of tetracycline treatment, 17: 5670(R) (LAMS-2780(p.17-84))
radiation effects on metabolism in rats, 17: 5670(R) (LAMS-2780(p.17-84))
STRONTIUM ISOTOPES Sr-86
abundance in continental soil, 17: 6291
STRONTIUM ISOTOPES Sr-87
abundance in continental soil, 17: 6291
STRONTIUM ISOTOPES Sr-89
content in rain water in New Zealand, 17: 5750(R) (DXRL-F6)
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
distribution in bone, correlation with bone tumors, 17: 5729
maximum permissible concentration for inhaled air, 17: 6331
STRONTIUM ISOTOPES Sr-90
bone tumors induced in mice by, relation of radiation dose and dose rate to frequency, 17: 5718
bone tumors induced by injected, in mice, relation of radiation dose and 17: 5718
content in human bones, effects of age on, 17: 5714
content in milk in United Kingdom, 1960, 17: 6363
content in milk in New Zealand, 17: 5750(R) (DXRL-F6)
content in milk, mathematical model of effects of transport mechanisms on, 17: 6353
content in rain water in New Zealand, 17: 5750(R) (DXRL-F6)
content of, in rain water, 17: 6272(R) (ORO-520)
determination in solution using scintillation detector, 17: 6446
determination of, in stratosphere, 17: 6271(R) (NYO-10464)
distribution in bones in sheep, 17: 5741
effects on chronic ingestion on reproduction in miniature swine, 17: 5700 (HW-74969)
effects on hematopoietic system in rats, 17: 5822
elimination from mice, dietary factors, 17: 5717
excretion in mice, effects of aluminum citrate on, 17: 5744
in fallout after French nuclear explosion, 17: 6272(R) (ORO-520)

levels of, in food, 17: 5751(R) (HASL-132)
levels of, in wheat, 17: 5751(R) (HASL-132)
maximum permissible concentration for inhaled air, 17: 6331
metabolism by fish, 17: 5708(T) (IPRS-15871)
metabolism in bones, in man, 17: 5715
monitoring in Ottawa River, program for, 17: 6334
pathological effects in mice, 17: 5907
pathological effects of ingested in fish, 17: 5701 (HW-SA-2255)
radiation sickness induced in rats by injected, 17: 5929
tropospheric residence time of, 17: 6272(R) (ORO-520)

STRONTIUM NITRATES
solubility in organic solvents, effects of water on, 17: 6190(T) (AEC-tr-5574)
transfer between heavy and light water, ionic hydration in, 17: 6096

STRONTIUM SULFATES
solubility in organic solvents, effects of water on, 17: 6190(T) (AEC-tr-5574)

STRONTIUM TITANATES
emissivity, 17: 6675(R) (PWA-2128)
emittance at high temperatures, total hemispherical, 17: 6731

STRUCTURES
blast loading of underground, 17: 5666 (AD-274294)
construction of underground shelters, 17: 6324 (USNRDL-TR-582)
gamma shielding afforded by, model studies, 17: 7497 (DRCL-364)
radiography of reinforced concrete, 17: 6249
simulants of dynamically loaded, use of models, 17: 5666 (AD-274294)

STYRENE POLYMERS
radioinduced reactions with silica gel, 17: 6140
scintillation properties of activated, effects of wave shifter concentration on, 17: 7122 (NP-12330(p.220-3))

STYRENES
radioinduced polymerization of, effects of water on, 17: 6124 (BNL-5838)
radioinduced polymerization, effects of variables, 17: 6175
spectra in gamma irradiated organic glasses at −196°C, 17: 6148

SUCCINATES
metabolism by *Staphylococcus aureus* and its radioinduced mutant, 17: 5790(T)

SUCROSE
radiolysis of solutions of, gas production in, 17: 6142

SULFATE IONS
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)

SULFONATES
genetic effects in barley, ethylmethane, synergistic effects with x radiation, 17: 5861

SULFOSALICYLATE COMPLEXES
analytical use in titrimetric determination of beryllium, 17: 6011

SULFUR
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination in uranium and uranium compounds by absorptiometric method, 17: 5966 (PG-Report-364)
protective effects against radiation damage in polymers, 17: 5923

SULFUR ISOTOPES S-32
neutron reactions (n,p) on, yields from epithermal and fast, 17: 7306

SULFUR ISOTOPES S-33
deuteron reactions (d,p) at 6.0 Mev, ground-state Q value and proton groups from, 17: 7247

SULFUR ISOTOPES S-34
energy levels, 17: 7247

SULFURIC ACID
separation from uranium by solvent extraction using di-(2-ethylhexyl)-phosphoric acid, 17: 6196

SUN
helium isotope abundance ratios in the, 17: 6911
microwave radiation sources, 17: 6906

SUPERCONDUCTIVITY
high field realization in ferromagnetic metals, 17: 6873
magnetic flux quantization in rings, 17: 6784 (CERN-62-30)
of solid solutions of noble metals, 17: 6860
theory of, adiabatic approximations in, 17: 6867

SUPERCONDUCTORS
critical currents in hard, theory of flux creep at, 17: 6876
critical persistent currents in hard, 17: 6875
development of niobium–tin and niobium–zirconium, 17: 6807 (UCRL-9819)
electronic thermal conductivity of, theory of intrinsic, 17: 6869
energy gap effect of paramagnetic impurities in, 17: 6878
interactions with magnetic fields, 17: 6784 (CERN-62-30)
magnetization and critical supercurrents in, 17: 6865
specific heat anomaly of, 17: 6893
transition metal alloy, upper critical fields of, 17: 6874
ultrasonic absorption in, theory of, 17: 6890
use in linear accelerators, 17: 7325 (BNL-6511(p.196-203))

SUPERHEATERS (NUCLEAR)
design and development, 17: 7601(R) (GNEC-254)
design for maritime use, 17: 7599(R) (GEMP-160)
development program for supercritical pressure-tube reactors, 17: 7624

SUPERSONIC FLOW
past wedges, analysis of inviscid magnetohydrodynamic, 17: 6898

SURFACE WATERS
radioactivity of, hazards of natural, 17: 6341
radioactivity of, in Lamalou and Bedarieux, 17: 6281
sampler design for, 17: 6398 (KY-423)
storage of, in underground cavities formed by nuclear explosions, 17: 5658 (TID-16647)
temperature reduction of, in rivers, 17: 6255 (HW-SA-2301)

SWEDEN
fallout monitoring, 1961, 17: 5763 (AE-80)

SWIMMING POOL REACTORS
neutron activation cross sections in, determination of, 17: 7100 (NP-12330(p.95-6))
startup of Belorussian IRT-2000, 17: 7637(T) (IPRS-15345)

SWINE
effects of chronic ingestion of strontium-90 in miniature, 17: 5700 (HW-74969)

SWITCHES
electric, development of high-speed transistorized, 17: 7542(R) (GEMP-75)
triggering mechanism for low-pressure spark-gap, 17: 6217

SYNCHROCYCLOTRONS
beam deflection system for CERN 600-Mev, 17: 7344 (CERN-62-25)
comparison with sector-focused, 17: 7379
dissociation of negative hydrogen ions in, 17: 7360

SYNCHROTRONS
beam injection, magnetic inflector for, 17: 7416
electromagnetic radiation emission by electrons in, 17: 6792(R) (ISS 62/14)
injector design for zero gradient proton, 17: 7310 (BNL-6511(p.7-18))
injector vacuum system for ZGS, 17: 7339 (BNL-6511(p.318-22))
radiation emission by high-energy electrons in, polarization of, 17: 7418

SYSTEMS FOR NUCLEAR AUXILIARY POWER
development and safety aspects of radioisotopic, 17: 7643(R) (MND-P-3016-1)
reactor temperature coefficients, 17: 7560 (NAA-SR-7140)

SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-2)
fuel element development for, 17: 6559

T

TANTALUM
adsorption of cesium ions on, 17: 6803 (UCRL-6389)
analysis, 17: 6022
bibliography on, 17: 6521 (NP-12417)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
determination, 17: 6022
determination in iron alloys, x-ray spectrochemical, 17: 5997
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
evaporation in vacuum, 17: 6726
gamma pair production cross sections for, 17: 7116 (NP-12330(p.186-92))
heat of sublimation and vaporization of solid, 17: 6093

ion ranges in, determination from collection experiments, 17: 6820
separation from niobium and titanium by solvent extraction, 17: 6022
surface properties of, studies by mass spectrometry, 17: 6634 (AFOSR-2273)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
welding, 17: 6631

TANTALUM ALLOYS
mechanical properties, 17: 6517 (MAB-188-M)
sheet rolling of, 17: 6517 (MAB-188-M)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Mo–Nb–Ta, properties of wrought, 17: 6672 (NP-12383)
Mo–Ta, properties of wrought, 17: 6672 (NP-12383)
Nb–Ta–V, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Ta–W, metallurgy of single crystals of, 17: 6688 (WADD-TR-60-37 (Pt.III))
Ta–W, preparation of single crystals of, by electron beam floating zone melting, 17: 6688 (WADD-TR-60-37(Pt.III))
Ta–W–Zr, phase studies, 17: 6668(R) (NMI-9246)

TANTALUM BORIDES
compact preparation, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)

TANTALUM CARBIDES
compact preparation, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
reflection spectra, 17: 6520(R) (NP-12373)
thermal conductivity, 17: 6520(R) (NP-12373)
TaC–W, tensile strength, 17: 6688 (WADD-TR-60-37(Pt.III))

TANTALUM ISOTOPES Ta-182
beta activity measurement from, in neutron dosimeter, 17: 5958 (PG-Report-306)
decay, 17: 7161
isomeric-pair production by neutron activation, yield ratios of, 17: 7248

TECHNETIUM
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
effects on structure and properties, 17: 6718

TECHNETIUM COMPLEXES
preparation and properties of cyano, 17: 6040 (JUL-68-RC)

TECHNETIUM FLUORIDES
transition points and vapor pressure of hexavalent, 17: 6083

TEETH
analysis of bovine for naturally-occurring radium-226, polonium-210, and thorium-228, 17: 5705 (TID-14604)
radiation effects on rat, gamma and 200-kv x, 17: 5867

TELEMETERING SYSTEMS
for strain gages, 17: 6405 (SCTM-364-61(73))
operation of, for reporting Columbia River data, 17: 6394 (HW-SA-2481)

TELLURIUM
effects on corrosion of chromium–zirconium alloys by water at 680°F and steam at 750°F, 17: 6561(R) (ARF-2198-34)
effects on corrosion of antimony–zirconium alloys by water at 680°F, 17: 6561(R) (ARF-2198-34)
effects on corrosion of iron–zirconium alloys by steam at 750°F, 17: 6561(R) (ARF-2198-34)

TELLURIUM ISOTOPES Te-125
proton reactions (p,xn) and (p,2pxn) at 120 to 660 Mev, cross sections for, 17: 7297

TELLURIUM ISOTOPES Te-126
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))
proton reactions (p,xn) and (p,2pxn) at 120 to 660 Mev, cross sections for, 17: 7297

TELLURIUM ISOTOPES Te-127
isomeric-pair production by neutron activation, yield ratios of, 17: 7248

TELLURIUM ISOTOPES Te-128
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))

TELLURIUM ISOTOPES Te-130
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))

TELLURIUM ISOTOPES Te-132
separation from irradiated uranium, 17: 6172
separation from irradiated uranium tetrafluoride, 17: 6173

TELLURIUM SYSTEMS
Bi–Ge–Te, properties as thermocouple, 17: 7642(R) (AD-276092)
Bi–Pb–Te, properties as thermocouple, 17: 7642(R) (AD-276092)
Bi–Te, radiation effects on electrical properties of, 17: 6441 (USNRDL-TR-581)

TEMPERATURE
effects on nervous responses in irradiated rats, 17: 5889
effects on phosphorus metabolism in irradiated tumor cells in culture, 17: 5832
measurement of, design of ceramic sensor for, 17: 7542(R) (GEMP-75)

TENSILE PROPERTIES
prediction of, 17: 6691 (WAPD-T-1335)

TERBIUM
determination in minerals and rocks, spectrographic, 17: 6008
separation from rare earths, 17: 6019
spectra in molybdates and tungstates, intensities of emission, 17: 6837

TERBIUM ISOTOPES
alpha decay systematics for, 17: 7199

TEREPHTHALIC ACID, ETHYLENE POLYMER ESTERS
fabrication of, for liquid–hydrogen target containers, 17: 6808 (UCRL-9824)

TERPHENYLS
pyrolytic fouling of, effects of inorganic compounds on, 17: 7561 (NAA-SR-7362)
radiolysis of o-, polymer yields in alpha, 17: 6139

TESTOSTERONE
effects on radiation injury of gonads in male rats, 17: 5796

TETRADECANE
determination in kerosene by vapor-phase chromatography, 17: 6195
C_nH_{n+2}–C_mH_{m+2}, diffusion of toluene in, 17: 6060

THALLIUM
separation by amalgam exchange, 17: 6132(R) (TID-17272)

THALLIUM ISOTOPES Tl-204
beta activity of, design of 4π beta plastic scintillator for measurement of, 17: 6459

THALLIUM NITRATES
transport number of cation in fused, 17: 6080

THERMAL CONDUCTIVITY
determination of, in anisotropic solids, development of method for, 17: 6640 (ASD-TDR-62-608(Pt.I))

THERMAL CYCLING
of stainless steel-clad uranium dioxide fuel elements, 17: 6513 (GEAP-4069)

THERMAL NEUTRONS
activation analysis with, parameters of, 17: 6026
capture in gadolinium, gamma spectra from, 17: 7182
diffraction scattering by solids, measurement of, 17: 7070
diffusion equilibrium in crystalline media, 17: 7129 (NP-12330(p.378-83))
diffusion in heavy water at 20 to 220°C, 17: 7058 (TID-15165)
diffusion of, effect of temperature gradients on, 17: 7071
distributions in low-enrichment superheater cells, 17: 7595(R) (ACNP-62018)
flux perturbation in diffusing media by the introduction of detectors, 17: 6484
reactions with uranium-235, fragment distributions and mechanisms in fission, 17: 7098 (NP-12330(p.79-85))
scattering by organic compounds, determination of carbon-hydrogen ratios by, 17: 5949 (BNL-5814)
scattering by spin system of paramagnetic materials, 17: 7073(T)

THERMIONIC CELLS
development of capillary emitters for, 17: 6788(R) (EDR-2791)
developments for space applications, 17: 6551
distribution and temperature of electrons in plasma regions of, 17: 7419 (AD-274920)
materials requirements for, 17: 6553

THERMOCOUPLES
performance of low-heat-flux, as solar generator, 17: 7642(R) (AD-276092)
production of heat-resistant, 17: 6381 (AD-254402)

THERMODYNAMICS
calculation for solids from dissociation-pressure data, 17: 6108

linear and non-linear non-equilibrium, 17: 6107
of isolated particles, new presentation of, 17: 6826
symposium on, of nuclear materials, 17: 6104
theory of magnetothermomechanics, 17: 6859
transport properties of matter in classical statistical, 17: 6818
THERMOELECTRIC CELLS
development of, status review of, 17: 6522 (NRL-Memo-1361)
developments for space applications, 17: 6551
performance, effects of surface heat transfer, 17: 6222
THERMOELECTRIC MATERIALS
development of, status review of, 17: 6522 (NRL-Memo-1361)
properties of sodium vanadyl vanadate (liquid) as, 17: 6633 (AD-274831)
radiation effects on electrical properties of, 17: 6441 (USNRDL-TR-581)
THERMONUCLEAR EXPLOSIONS
effects of high-altitude, on spread F development in the ionosphere, 17: 6848
effects on geomagnetic fields, 17: 6841
fallout effects in man, eight-year survey on Marshallese exposed to, 17: 5699 (BNL-6503)
formation of atomic cloud, 17: 6307 (CDRP-182-112)
hazards to man near ground zero, 17: 6347
production of iodine isotopes by, 17: 6322 (UCLA-499)
THERMONUCLEAR REACTIONS
formation of platinum-group elements by, in fission explosions, 17: 7242
THERMONUCLEAR REACTORS
experiments in Western Europe, review of, 17: 7453
plasma instabilities in magnetic-mirror and toroidal, 17: 7448
THERMOPILES
design and performance for neutron flux measurements, 17: 6485
THERMOSTATS
design of, for electronic components, 17: 6792(R) (ISS 62/14)
THICKNESS GAGES
design and performance of alpha, for measuring density of gases and thin films, 17: 6422
eddy current type, for measuring Zircaloy walls, 17: 6391 (DP-663)
THIOLS
effects of photochemical reactions of benzophenone with 2-propanol, 17: 6146
protective effects against radiation injury, reaction mechanisms, 17: 5931
THIOPHENES
2-bromo-5-chloro-, frequency sweep double resonance spectra of, 17: 6076
THOREX PROCESS
development of, status review of, 17: 6186 (ORNL-TM-420)
product activity and specifications in, 17: 6185 (ORNL-2056)
THORIUM
abundance in Conway granite in New Hampshire, 17: 6297
analysis, 17: 6021
determination in fluorides by titration with EDTA, use of vanadyl ion as back-titrant in, 17: 5995
determination in granites, 17: 6297
determination in ores and soils, 17: 6021
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)
determination using chlorophosphonazo III, photometric, 17: 6016
fabrication of Thorex-Process product, hazards analysis and specifications in, 17: 6185 (ORNL-2056)
leaching from rocks, geochemical, 17: 6281
separation from aqueous chloride, nitrate, or perchlorate solutions by solvent extraction using acidic phosphonate, 17: 6189 (TID-15313)
separation from chloride solutions by solvent extraction using mono-2-ethyl hexyl phosphoric acid, synergistic effects in, 17: 6188 (TID-15271)
separation from plutonium, anion-exchange, 17: 6187 (TID-14598)
separation from rare earths, methods of, 17: 6021
substitution for calcium, in apatites, 17: 6061
THORIUM ALLOYS
Mo–Th, phase diagrams, 17: 6659 (IS-442)
THORIUM CARBIDES
crystal structure, 17: 6692(T) (AEC-tr-5486)
production of coated particles for fission product retention, testing methods for, 17: 7577
thermodynamic properties, 17: 6052 (TID-17413)
vaporization, 17: 6109
ThC_2–UC_2, properties of particles of, 17: 6655 (GA-3067)
ThC_2–UC_2, properties of carbon-coated particles of, 17: 6655 (GA-3067)
THORIUM COMPLEXES
spectra of organophosphorus-trifluorothenoyl acetone, infrared, 17: 6050 (TID-15323)
with arsenazo III, formation mechanism of, 17: 6007
THORIUM FLUORIDES
effects on freezing point of sodium fluoride, 17: 6088
BeF_2–LiF–ThF_4–UF_4–ZrF_4, phase studies, 17: 7562(R) (ORNL-3369)
THORIUM(IV) FLUORIDES
BeF_2–LiF–ThF_4, phase studies at high temperatures, 17: 7606(R) (ORNL-1515)
THORIUM ISOTOPES Th-228
content in bone after injection of Thorotrast, 17: 5707 (TID-15308)
determination of naturally-occurring in bovine bones and teeth, 17: 5705 (TID-14604)
THORIUM ISOTOPES Th-230
determination of, in uranium ore concentrates and liquors, 17: 5964 (PG-Report-356)
THORIUM ISOTOPES Th-232
content in bone after injection of Thorotrast, 17: 5707 (TID-15308)
decay spectra of, 17: 5733
fission of, by protons at 600 Mev, 17: 7086 (NP-12319)
THORIUM ISOTOPES Th-234
decay, gamma emissions in, 17: 7160
THORIUM NITRATES
handling of Thorex-Process product, hazards analysis and specifications in, 17: 6185 (ORNL-2056)
hydrolysis in dilute solution, 17: 6079
THORIUM OXIDE CRYSTALS
neutron diffraction, Bragg reflections, 17: 6417
THORIUM(IV) OXIDES
translocation of injected, to skeleton, 17: 5707 (TID-15308)
ThO_2–UO_2, processing of irradiated, 17: 6186 (ORNL-TM-420)
ThO_2–W, tensile strength, 17: 6688 (WADD-TR-60-37(Pt.III))
THORIUM SULFIDES
properties, 17: 6636 (ANL-FGF-247)
sintering, 17: 6636 (ANL-FGF-247)
THORIUM SYSTEMS
C–Th–U, thermal conductivity of stoichiometric, 17: 6511(R) (BMI-1593(Del.))
THULIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
separation from rare earths, 17: 6019
THULIUM ISOTOPES Tm-168
decay of, rotation of angular correlations in, 17: 7270
THULIUM ISOTOPES Tm-169
gamma resonance absorption by, anomalies in, 17: 6879
THULIUM ISOTOPES Tm-170
beta-gamma directional correlations in, 17: 7218
gamma specific emission coefficient, 17: 6431 (CEA-2036)
THYMIDINE
radiation chemistry of tritium-labeled, 17: 5675(R) (LAMS-2780(p.246-317))
THYMUS
chemical protection of cells in culture against radiation injury, 17: 5922
THYROID DISEASES
effects on iodine-131 excretion in milk of cattle, 17: 5721
radiotherapy of, effects on leukocyte chromosomes, 17: 5845
THYROID GLAND
analysis for abnormal radioactivity in sheep and cattle in Portugal, 17: 5740
analysis of sheep, for iodine-131, samples collected in Portugal, 1960, 17: 6354
function studies using iodine-131, 17: 5673(R) (LAMS-2780(p.181-210))
iodine-131 release by, effects of dairy cattle forage on, 17: 5723
iodine-131 uptake by, 17: 5743
tumors induced in, in sheep fed iodine-131, 17: 5768 (HW-SA-2493)

THYROID HORMONES
effects on resistance to infections in irradiated rats, 17: 5885
THYROXINE
effects on erythropoiesis in irradiated rats, tracer study, 17: 5883
TIME MEASUREMENT
design of equipment for microsecond, 17: 6404 (SCTM-168-60(24))
TIMING CIRCUITS
design and characteristics of delayed, 17: 6435 (IEA-50)
development for stepping magnetic field of Compton Spectrometer, 17: 6438 (TID-15530)
TIN
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination in niobium, tantalum, and tungsten, spectrometric, 17: 6022
gamma pair production cross sections for, 17: 7116 (NP-12330(p.186-92))
helium nucleus (helium-3) scattering at 31 Mev, elastic, 17: 7148 (UCRL-9996)
separation by solvent extraction using alkyl phosphoric acid, 17: 6200
separation from europium by ion exchange, 17: 7125 (NP-12330(p.253-7))
TIN ALLOYS
Fe–Sn–Zr, structures in, 17: 6527 (TID-7625(p.30-41))
Nb–Sn, intermediate phases in, 17: 6703
Nb–Sn, superconductivity of, critical persistent currents in, 17: 6875
Nb–Sn, superconductivity in, 17: 6807 (UCRL-9819)
Nb–Sn–Zr, corrosion in water and steam, 17: 6535(T) (EURAEC-352)
Nb–Sn–Zr, corrosion by steam and water, 17: 6581
Nb–Sn–Zr, fabrication of tubing of, 17: 6600(T) (EURAEC-354)
Nb–Sn–Zr, mechanical properties of, hydrogen effects on, 17: 6696(T) (EURAEC-353)
Nb–Sn–Zr, phase studies, 17: 6697(T) (EURAEC-358)
Nb–Sn–Zr, welding, 17: 6535(T) (EURAEC-352)
Sn–Zn, entropy of liquid, electronic contribution in mixing to, 17: 6044 (NP-12311)
TIN COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
TIN COMPOUNDS
gamma transition of tin-119 at 23.8 kev in organo-, 17: 7281
TIN HYDRIDES
mass spectra of volatile, 17: 6791 (IS-424)
TIN ISOTOPES
proton reactions at 57 Mev on, proton distributions from, 17: 7197
TIN ISOTOPES Sn-114
energy levels, 17: 7210
TIN ISOTOPES Sn-116
energy level lifetimes, 17: 7110 (NP-12330(p.152-7))
TIN ISOTOPES Sn-119
gamma transition at 23.8 kev in organo-tin compounds, 17: 7281
Mössbauer line in $Sn^{119}O_2$, ultrasonic splitting of, 17: 6889
TIN ISOTOPES Sn-120
helium nucleus (helium-3) scattering at 31 Mev, elastic, 17: 7148 (UCRL-9996)
TIN ISOTOPES Sn-126
decay, 17: 7139 (TID-14799)
TIN ISOTOPES Sn-127
decay, 17: 7139 (TID-14799)
TIN ISOTOPES Sn-128
decay, 17: 7139 (TID-14799)
TIN ISOTOPES Sn-129
decay, 17: 7139 (TID-14799)
TIN OXIDES
Mössbauer line in $Sn^{119}O_2$, ultrasonic splitting of, 17: 6889
TISSUE CULTURES
chemical protection of thymus cells in, against radiation injury, 17: 5922
growth, effects of beta irradiation from internal tritium in HeLa cells, 17: 5773 (TID-13613)
of HeLa cells, factors affecting growth, 17: 5674(R) (LAMS-2780(p.211-45))
of human and monkey leukocytes, 17: 5676 (SAM-TDR-62-99)
phosphorus metabolism in tumor cells, effects of radiation and temperature, 17: 5832
radiosensitivity of cells from female genital tumors, 17: 5865
TISSUES
heterogeneity compensation in high-energy radiotherapy, use of aluminum, 17: 5680
irradiation using yttrium-90 needles, 17: 5695
penetration and energy loss of charged heavy particles in, 17: 5766 (BNL-5538)
radiation effects on quinone content, 17: 5880
transplantation of, effects of animal immunity on, 17: 5814
transplantation reactions, 17: 5762(R) (AD-276039)
TITANIUM
bibliography on, 17: 6521 (NP-12417)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination using chlorphosphonazo III, photometric, 17: 6016
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
effects of additions of, on extrusion and forging of molybdenum alloys, 17: 6589 (ASD-TDR-62-670)
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
separation from metallic mixture by ion exchange chromatography, 17: 5991
separation from tantalum by solvent extraction using cyclohexane, 17: 6022
separation of tetravalent, by liquid-liquid column extraction from trivalent iron, 17: 6183 (IS-423)
sorptive properties for hydrogen, 17: 6699(T) (SCL-T-451)
sorptive properties for deuterium, 17: 6699(T) (SCL-T-451)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
TITANIUM ALLOYS
analysis for tantalum using arsenazo, 17: 6022
broaching, 17: 6622
drilling, 17: 6615
end milling of U-500, 17: 6614
milling, 17: 6612
temperature effects on mechanical properties of, cryogenic, 17: 6542
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Al–Nb–Ti, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)
Al–Ti, elastic properties, 17: 6709
Al–Ti, phase studies, 17: 6729
Al–Ti–V, stress-corrosion, 17: 6569(R) (NP-12369)
Cr–Cu–Fe–Mo–Ni–Ti, corrosion of, by reactor fuel dissolver solutions, 17: 6566 (HW-SA-2307)
Mo–Nb–Ti, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Ti, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Ti, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Mo–Ti, strength of, effects of boron additions on, 17: 6672 (NP-12383)
Mo–Ti–Zr, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Ti–Zr, phase studies, 17: 6668(R) (NMI-9246)
Mo–Ti–Zr, powder metallurgy, 17: 6668(R) (NMI-9246)
Mo–Ti–Zr, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Nb–Ti–V, protective coatings for, 17: 6562(R) (ARF-B-6001-1)
Ni–Ti, diffusion of, in C–Ni system, 17: 6591 (ASD-TDR-62-734)
Ni–Ti, diffusion of, in B–Ni system, 17: 6591 (ASD-TDR-62-734)
Ti–W, properties of wrought, 17: 6672 (NP-12383)
Ti–W–Zr, properties of wrought, 17: 6672 (NP-12383)
TITANIUM BORIDES
compact preparation, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
thermal conductivity, 17: 6520(R) (NP-12373)
$Ni–TiB_2$, preparation, 17: 6591 (ASD-TDR-62-734)
TITANIUM CARBIDES
compact preparation, 17: 6520(R) (NP-12373)
corrosion by fused fluorides and liquid metals, 17: 7606(R) (ORNL-1515)
ductility, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)

reflection spectra, 17: 6520(R) (NP-12373)
Ni–TiC, preparation, 17: 6591 (ASD-TDR-62-734)
TITANIUM COATINGS
Cr–Si–Ti, for niobium alloys, 17: 6510 (ASD-TDR-62-934)
TITANIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
TITANIUM HYDRIDES
meson (π^-) capture by hydrogen in, 17: 7083 (JINR-P-1081)
TITANIUM ISOTOPES Ti-46
neutron reactions (n,p) on, yields from epithermal and fast, 17: 7306
TITANIUM ISOTOPES Ti-48
neutron reactions (n,p) on, yields from epithermal and fast, 17: 7306
TITANIUM NITRIDES
reflection spectra, 17: 6520(R) (NP-12373)
TITANIUM OXIDES
emittance at high temperatures, total hemispherical, 17: 6731
Al_2O_3–Fe_2O_3–TiO_2, emissivity, 17: 6675(R) (PWA-2128)
Al_2O_3–TiO_2, total hemispherical emittance at high temperatures, 17: 6731
Fe_2O_3–TiO_2, emissivity, 17: 6675(R) (PWA-2128)
Fe_2O_3–TiO_2, endurance of coating, 17: 6675(R) (PWA-2128)
TITANIUM(IV) OXIDES
effects on europium oxide stability and hydration resistance, 17: 6664 (MND-M-2346)
emissivity, 17: 6675(R) (PWA-2128)
endurance of coating of, 17: 6675(R) (PWA-2128)
TITANIUM SYSTEMS
O–Si–Ti–W–Zr, oxidation resistance of, testing as tungsten coating, 17: 6519(R) (NP-12293)
O–Ti, thermodynamic properties of, 17: 6111
TOLUENE
diffusion in n-decane and n-hexane systems, 17: 6060
TOLUENE, VINYL- POLYMERS
preparation of cross-linked, containing organic additions for use as scintillating anion resins, 17: 5940(R) (TID-15720)
TOWER SHIELDING FACILITY
design and characteristics, 17: 7606(R) (ORNL-1515)
TOXICOLOGY
book: *Handbook on Toxicology of Radioisotopes*, 17: 5748
TOXINS
effects of 2-octanol type, on glycolysis hindrance in ascites tumor cells, 17: 5900
TRACER TECHNIQUES (BIOLOGY)
blood circulation in cerebrum, 17: 5711
evaluation of kinetic data for metabolic studies, 17: 5726
force-feeding method for administering radioisotopes to fish, 17: 5738
retention of tracers in dry ashing of blood, 17: 5716
TRACER TECHNIQUES (CHEMICAL ENGINEERING)
performance characteristics evaluation using, 17: 6373
use of krypton-85 for measuring gas flow, 17: 6366
TRACER TECHNIQUES (CHEMISTRY)
for studying adsorption on surfaces, 17: 6078
studies of competing reactions of free radicals, 17: 6071
TRACER TECHNIQUES (MEDICINE)
design of arm counter for repeated isolated counting, 17: 5677 (TID-14613)
diagnostic, use of whole-body scanning, 17: 5806
using whole-body counting in study of iron-59 metabolism, 17: 5746
using whole-body counting in double tracer study of absorption of vitamin B_{12} labeled with cobalt-58 and cobalt-60, 17: 5746
TRANSDUCERS
design of, for measurements of electric conductivities in arc plasma jets, 17: 7493
TRANSITION METALS
chemistry of, compared with actinides and lanthanides, 17: 6090
chemistry of, compared with actinides and lanthanides, 17: 6091
mesic atom (μ^-) decay in, anomaly in, 17: 6888
superconductivity of alloys of, upper critical fields of, 17: 6874
TRAUMA
effects on brain function, 17: 5886
radioactive contamination of wounds, surgical treatment, 17: 6325(T) (JPRS-16072)
TRIETHYLENETETRAMINE
salicylaldehyde cobalt chloride, radiation damage annealing in, 17: 7135 17: 7135 (NP-12330(p.422-8))
TRIOXANES
radioinduced polymerization, 17: 6155
TRITIUM
binding energy, 17: 7089 (NP-12330(p.15-16))
biological effects of internal beta irradiation from, in HeLa cells, 17: 5773 (TID-13613)
determination in amino acids by continuous scintillation counting, 17: 5709
determination of, in atmospheric hydrogen, 17: 5947(R) (AFCRL-62-295)
determination of, in atmospheric methane, 17: 5947(R) (AFCRL-62-295)
determination of, in meteorites, 17: 5947(R) (AFCRL-62-295)
exchange with hydrogen in Tamalpais event, 17: 5937 (ORNL-TM-445)
health hazards control of, at Savannah River Plant, 17: 6309 (DPSPU-62-30-5)
labeling of methane by, mechanism of, 17: 6781(R) (ANL-6603(p.57-73))
leak detector for, 17: 6390 (DP-198)
lethal effects of radiation from incorporated on *Escherichia coli*, 17: 5793
physiological effects of radiation from, in yeast cells, 17: 5719
quantitative determination of, bibliography on, 17: 6035 (DP-511)
reactions of recoil atoms with cyclopropane platinous chloride, 17: 6087
TRITONS
interactions with deuterons, neutron spectra from, 17: 7241
production by proton reactions with aluminum, beryllium, and iron at 30 Bev, 17: 7259
reactions (t,p) and (t,α) with helium-3, 17: 7250
reactions (t,p) with carbon-12 at 0.32 to 1.18 Mev, cross sections for, 17: 7296
TRYPTOPHAN
radiation chemistry of aqueous solutions, 17: 6163
TUMBLER OPERATION
shock waves in, effect of topography on, 17: 6276 (WT-502)
TUMORS
glycolysis hindrance in cells of, effects of cell toxin and x rays on, 17: 5900
growth in mice, effects of x-irradiated cell injections on, 17: 5824
induction by 3-methylcholanthrene and x radiation in breasts of rats, 17: 5839
phosphorus metabolism in cells in culture, effects of radiation and temperature, 17: 5832
radiodiagnosis by differential uptake of labeled materials and whole-body scanning, 17: 5806
radioinduced chromosome aberrations, effects on cell viability, 17: 5890
radioinduced in thyroid gland in sheep fed iodine-131, 17: 5768 (HW-SA-2493)
radiosensitivity of female genital, 17: 5865
radiosensitivity of cervical uterine, 17: 5869
radiosensitivity of cervical uterine, possibility of increasing, 17: 5870
radiosensitivity of rat epithelioma, 17: 5812
radiotherapy of gynecologic, evaluation by cytologic examination of vaginal cells, 17: 5864
radiotherapy of malignant, effects on peripheral blood picture in man, 17: 5850
radiotherapy of malignant, evaluation of cost and effectiveness of supervoltage, 17: 5682
radiotherapy of pituitary, 17: 5840
radiotherapy of, use of aluminum compensator for tissue heterogeneity in high-energy, 17: 5680
radium therapy of gynecologic, effects on blood coagulation, 17: 5818
statistical analysis of incidence in populations of Hiroshima and Nagasaki, 17: 6333
TUNGSTATES
spectra of europium and terbium ions in, intensities of emission, 17: 6837
TUNGSTEN
adsorption of cesium ions on, 17: 6803 (UCRL-6389)
analysis for zirconium by solvent extraction using cupferron, 17: 6012
bibliography on, 17: 6521 (NP-12417)
coatings for, development of oxidation-resistant, 17: 6519(R) (NP-12293)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)

determination in iron and steel alloys, x-ray spectrochemical, 17: 5997
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
elastic properties, 17: 6520(R) (NP-12373)
electron emission by helium ion bombardment, energy distribution of, 17: 6853
exploding-wire phenomena in, effects of plasma from, 17: 7495
fabrication and properties of rolled sheet, 17: 6597(R) (DMIC-176)
ion ranges in, determination from collection experiments, 17: 6820
joining, 17: 6631
mechanical properties, 17: 6688 (WADD-TR-60-37(Pt.III))
metallurgy, 17: 6688 (WADD-TR-60-37(Pt.III))
neutron capture cross sections, fast, 17: 7606(R) (ORNL-1515)
plasma spraying of, 17: 6556
properties of wrought, 17: 6672 (NP-12383)
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
radiation effects on mechanical properties of, deuteron, 17: 6736 (AFCRL-62-515)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))

TUNGSTEN ALLOYS
extrusion, 17: 6589 (ASD-TDR-62-670)
forging, 17: 6589 (ASD-TDR-62-670)
mechanical properties, 17: 6517 (MAB-188-M)
sheet rolling of, 17: 6517 (MAB-188-M)
thermal radiative properties, 17: 6650 (DMIC-177(Vol.I))
Cr–Co–Ni–W, machining characteristics of HS-25, 17: 6609
Cr–Co–Ni–W, machining of HS-25, 17: 6611
Fe–Mo–Ni–W, coatings for, 17: 6563 (DC-61-7-6)
Hf–W, properties of wrought, 17: 6672 (NP-12383)
Mo–Nb–W, extrusion, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W, melting, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W, workability, 17: 6592 (ASD-TDR-62-781)
Mo–Nb–W–Zr, fabrication and properties of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Os–W, phase studies, 17: 6668(R) (NMI-9246)
Mo–W, deoxidation, 17: 6672 (NP-12383)
Mo–W, extrusion, 17: 6589 (ASD-TDR-62-670)
Mo–W, forging, 17: 6589 (ASD-TDR-62-670)
Mo–W, mechanical properties of wrought, 17: 6672 (NP-12383)
Mo–W, melting, 17: 6672 (NP-12383)
Pd–W, powder metallurgy, 17: 6668(R) (NMI-9246)
Pt–W, superconductivity of solid solutions of, 17: 6860
Ta–W, metallurgy of single crystals of, 17: 6688 (WADD-TR-60-37 (Pt.III))
Ta–W, preparation of single crystals of, by electron beam floating zone melting, 17: 6688 (WADD-TR-60-37(Pt.III))
Ta–W–Zr, phase studies, 17: 6668(R) (NMI-9246)
Ti–W, properties of wrought, 17: 6672 (NP-12383)
Ti–W–Zr, properties of wrought, 17: 6672 (NP-12383)
W–Zr, properties of wrought, 17: 6672 (NP-12383)

TUNGSTEN BRONZE
electrical properties, 17: 6658 (IS-433)

TUNGSTEN CRYSTALS
mechanical properties, 17: 6688 (WADD-TR-60-37(Pt.III))
metallurgy, 17: 6688 (WADD-TR-60-37(Pt.III))
preparation of, by electron beam floating zone melting, 17: 6688 (WADD-TR-60-37(Pt.III))

TUNGSTEN ELECTRODES
burn-out of, in uranium dioxide melting furnace, 17: 6601(T,R) (EURAEC-372)

TUNGSTEN ISOTOPES W-182
electron conversion spectrum of excited levels in, 17: 7161
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290

TUNGSTEN ISOTOPES W-184
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290
fission of, by protons at 600 Mev, 17: 7086 (NP-12319)
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))

TUNGSTEN ISOTOPES W-186
energy levels with spin and parity 4^+ produced by cascade Coulomb excitation with nitrogen-14 ions at 50 Mev, 17: 7290

TUNGSTEN SYSTEMS
HfO_2–W, tensile strength, 17: 6688 (WADD-TR-60-37(Pt.III))
O–Si–Ti–W–Zr, oxidation resistance of, testing as tungsten coating, 17: 6519(R) (NP-12293)
TaC–W, tensile strength, 17: 6688 (WADD-TR-60-37(Pt.III))
ThO_2–W, 17: 6688 (WADD-TR-60-37(Pt.III))

TURBINES
broaching of René 41 wheels, 17: 6623

U

ULTRASONICS
absorption by superconductors, theory of, 17: 6890
use in jack hammers, development of styli for, 17: 6201 (ANL-FGF-300)

ULTRAVIOLET RADIATION
adaptation of plants to, under near-cosmic conditions, 17: 5781(T) (FTD-TT-62-771)
biological effects, 17: 5894
detection and measurement at 50 to 1500Å, design of instrument using phototubes for, 17: 6411 (WADD-TR-60-371)
reactions with molecules of desoxyribonucleic acid, 17: 5894

ULTRAVIOLET SOURCES
design of hot-plasma type, for region from 50 to 1500Å, 17: 6411 (WADD-TR-60-371)

UNDERGROUND EXPLOSIONS
AARDVARK seismological data, 17: 6267 (NP-12328)
cavity formation by, for water storage, 17: 5658 (TID-16647)
detection of, conference on, 17: 6265 (NP-12297)
gas sampling of Tamalpais, 17: 5937 (ORNL-TM-445)
industrial applications in Plowshare Project, 17: 6215
seismic measurements of DANNY BOY, 17: 6268 (NP-12419)
seismic measurements of Hyrax, 17: 6269 (NP-12420)
seismic signals from Fisher, long-range measurements of, 17: 6259 (NP-12279)
seismic signals from Sedan, long-range measurements of, 17: 6261 (NP-12281)
seismic signals from Merrimac, long-range measurements of, 17: 6262 (NP-12282)
seismic signals from Agouti, long-range measurements, 17: 6263 (NP-12283)
seismic signals from Antler, long-range measurements, 17: 6264 (NP-12284)
seismic signals from Chinchilla, long-range measurements of, 17: 6266 (NP-12298)

URANIUM
analysis for cadmium by precipitation with bismuthiol, 17: 5953 (IEA-48)
analysis for impurities, visual, 17: 6528 (TID-7625(p.45-51))
analysis for sulfur by absorptiometric method, 17: 5966 (PG-Report-364)
analysis for zinc, spectrophotometric, 17: 6001
analysis for zirconium, volumetric, 17: 7606(R) (ORNL-1515)
analysis of, for iron using 1,10-1-phenanthroline, 17: 5962 (PG-Report-345)
analysis of, for uranium, 17: 5957 (PG-Report-294)
bonding of nickel-plated, to aluminum by pressure, 17: 6606
book: *Uranium Metallurgy. Vol. I. Uranium Process Metallurgy*, 17: 6539
book: *Uranium Metallurgy. Vol. II. Uranium Corrosion and Alloys*, 17: 6540
content in open waters, 17: 6341
corrosion, book, 17: 6540
crystal structure variations in alpha, at low temperatures, 17: 6721
detection of, fixed in oily fruits, 17: 6284
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination in solutions using nuclear emulsions, 17: 6003
determination in zirconium ores, spectrographic, 17: 6013
determination in zirconium alloys, 17: 6020
determination of, calorimetric, 17: 5950 (GAT-471)
determination of, in trioctyl phosphine oxide complexes by method of continuous variations, spectrophotometric, 17: 5955 (JÜL-74-PC)
determination of ratio of, to plutonium in feed solutions, 17: 5961 (PG-Report-340)

exploration for, in South Alligator Area of Australia, 17: 6277
extraction in counter-current annulus columns, 17: 6178 (AERE-R-4091)
fission product release from metallic, mechanism of, 17: 6174
joining, 17: 6629
metallurgy, book, 17: 6539
microstructure of, transformation effects on, 17: 6680 (TID-15539)
neutron fission of, kinetic energy of fragments as a function of alpha-particle energy in ternary, 17: 7279
oxidation by oxygen at partial pressure of 10^{-3} Torr at 200 to 370°C, 17: 6582
phase transitions in, α/β, 17: 6713
photoelectron distribution from, gamma energy dependence of, 17: 6833
photon reactions (γ,e) at 122 kev, cross sections, 17: 7203
piercing of, rotary, 17: 6594 (BRB-66)
preferred orientation measurement in, technique for, 17: 6681 (TID-17492)
radioinduced growth in, anisotropic, 17: 6762
recovery from waste solutions, 17: 7650 (BM-RI-6114)
separation from carbonate solutions by solvent extraction using cetyl-dimethyl-benzyl ammonium chloride, 17: 6198
separation from chloride solutions by solvent extraction using mono-2-ethyl hexyl phosphoric acid, synergistic effects in, 17: 6188 (TID-15271)
separation from irradiated fuel elements, role of metallic reactions in, 17: 6184 (NBS-7582)
separation from leach solutions by ion exchange, 17: 6193
separation from sulfuric acid solutions by solvent extraction using di-(2-ethylhexyl)-phosphoric acid, 17: 6196
swelling of, on postirradiation annealing, 17: 6737 (ANL-6532)
thermal expansion coefficients for, calculation of, 17: 6682 (TID-17495)
tubing fabrication from, 17: 6594 (BRB-66)
urinary excretion, correlation with environmental contamination, 17: 5703 (TID-12729)
vapor pressure of liquid, 17: 6106
vaporization under vacuum, 17: 6110

URANIUM (Zr ALLOY CLAD)
development of, for use in heavy water reactors, 17: 7597(R) (DP-785)

URANIUM ALLOYS
analysis for impurities, visual, 17: 6528 (TID-7625(p.45-51))
analysis for iron, colorimetric, 17: 5978 (TID-15319)
book: *Uranium Metallurgy, Vol. II, Uranium Corrosion and Alloys*, 17: 6540
properties of fissium-, effects of technetium on, 17: 6718
Al–Fe–U, phase studies, 17: 6727
Bi–U, light absorption by vaporous, relations with thermodynamic properties, 17: 6802 (TID-17348)
Bi–U, thermodynamics, 17: 6106
Mo–U, analysis for impurities, visual, 17: 6528 (TID-7625(p.45-51))
Mo–U, annealing of quenched, reaction mechanisms in, 17: 6716
Mo–U, electron microscope studies of thin films of, 17: 6712
Mo–U, radiation effects, 17: 7563(R) (PRDC-TR-59)
Mo–U–V, properties and structure, 17: 6725
Nb–U, analysis for impurities, visual, 17: 6528 (TID-7625(p.45-51))
Pu–U–fissium, separation from rhodium by anion exchange, 17: 5985
Pu–U–fissium, spectrophotometric analysis for rhodium, 17: 5985
U–Zr, corrosion of, effects of hydrogen on, 17: 6585

URANIUM CARBIDES
deposition from vapors, 17: 6110
extrusion, 17: 6533(T,R) (EURAEC-325)
flow characteristics of, high-temperature, 17: 6554
oxidation of, by carbon dioxide, 17: 6665 (NAA-SR-7482)
production of coated particles for fission product retention, testing methods for, 17: 7577
radiation effects, 17: 6533(T,R) (EURAEC-325)
thermodynamic properties, 17: 6052 (TID-17413)
vaporization under vacuum, 17: 6110
graphite-UC_x, radiation effects on, 17: 6748 (ORNL-3340)
PuC–UC, thermal expansion, 17: 6662 (LA-2768)
ThC_2–UC_2, properties of particles of, 17: 6655 (GA-3067)
ThC_2–UC_2, properties of carbon-coated particles of, 17: 6655 (GA-3067)

URANIUM CARBONATES
processing for uranium separation by solvent extraction using cetyl-dimethyl-benzyl ammonium chloride, 17: 6198

URANIUM(III) CHLORIDES
reduction of, by aluminum in molten alkali metal bromides or chlorides, 17: 6037 (HW-SA-2537)

URANIUM(IV) CHLORIDES
KCl–UCl_4, petrology, 17: 7606(R) (ORNL-1515)
NaCl–UCl_4, petrology, 17: 7606(R) (ORNL-1515)

URANIUM COMPLEXES
analysis of uranyl trioctyl phosphine oxide, spectrophotometric, 17: 5955 (IÜL-74-PC)
spectra of organophosphorus-trifluorothenoyl acetone, infrared, 17: 6050 (TID-15323)
with arsenazo III, formation mechanism of, 17: 6007

URANIUM COMPOUNDS
analysis for sulfur by absorptiometric method, 17: 5966 (PG-Report-364)
thermodynamics, 17: 6106

URANIUM CONCENTRATES
analysis of, for polonium-210, 17: 5964 (PG-Report-356)
analysis of, for thorium-230, 17: 5964 (PG-Report-356)

URANIUM CRYSTALS
plastic deformation and rupture at −196°C, 17: 6707

URANIUM DEPOSITS
survey of, in Western Europe, 17: 6292

URANIUM DEPOSITS (FRANCE)
occurrence in lava of Puys Chain, 17: 6279

URANIUM FIRES
control by extinguishant, 17: 6321 (TRG-Report-342)

URANIUM FLUORIDES
effects on freezing point of sodium fluoride, 17: 6088

URANIUM(IV) FLUORIDES
analysis of, for uranium, 17: 5957 (PG-Report-294)
production of iodine-132 from irradiated, 17: 6173
BeF_2–LiF–ThF_4–UF_4–ZrF_4, phase studies, 17: 7562(R) (ORNL-3369)
NaF–UF_4–ZrF_4, phase studies, 17: 7606(R) (ORNL-1515)
NaF–UF_4–ZrF_4, thermal capacity at 550 to 850°C, 17: 7606(R) (ORNL-1515)

URANIUM(VI) FLUORIDES
precipitation of ammonium diuranates, 17: 5935 (CEA-2204)

URANIUM HYDRIDES
thermodynamic functions of, calculation from dissociation-pressure data, 17: 6108

URANIUM IONS
thermodynamic properties of aqueous, 17: 6106

URANIUM(IV) IONS
determination in sodium sulfate–sodium tripolyphosphate system, polarographic, 17: 5990
production by electrolytic reduction of uranyl sulfate, 17: 6177 (IEA-47)

URANIUM ISOTOPES
alpha decay systematics for, 17: 7199
determination in natural waters of Hungary, 17: 6293

URANIUM ISOTOPES U-232
gamma emission, excitation spectrum, 17: 7208

URANIUM ISOTOPES U-234
neutron fission to 4 Mev, cross sections and angular distributions, 17: 7204

URANIUM ISOTOPES U-235
determination of, in impure uranium materials using neutron activation techniques, 17: 5979 (TID-15359)
determination of, in reactor fuels by radiometry, 17: 6473
energy levels, 17: 7277
fission of, isotonic and isotopic yields in, 17: 7085 (NP-12309)
gamma emissions of, 17: 5733
neutron fission of, angular anisotropy of gamma radiation from, 17: 7293
neutron fission of, fragment distribution and mechanisms in thermal, 17: 7098 (NP-12330(p.79-85))

URANIUM ISOTOPES U-238
decay spectra of, 17: 5733
fission of, by protons at 600 Mev, 17: 7086 (NP-12319)
fission of, kinetic energy of fragments emitted in subbarrier, 17: 7300
neutron fission of, alpha emission in fast, 17: 7097 (NP-12330(p.71-8))
photofission product energy distributions from, 17: 7291

URANIUM LEACH RESIDUES

analysis of, for tributyl phosphate using infrared absorption spectrometry, 17: 5974 (PG-Report-407)
URANIUM LEACH SOLUTIONS
processing by ion exchange, 17: 6193
URANIUM ORE PROCESSING PLANTS
waste disposal in, 17: 7650 (BM-RI-6114)
URANIUM ORES
prospecting for, geochemical, 17: 6252 (CEA-2154)
URANIUM(IV) OXIDE CRYSTALS
preparation of dense self-supported shapes of, by electrodeposition, 17: 6514 (HW-74784)
radiation effects, 17: 7548(R) (HW-74761(p.4.1-47))
URANIUM(IV) OXIDE POWDERS
coating of, properties of metal oxides for, 17: 6511(R) (BMI-1593(Del.))
fabrication, 17: 7548(R) (HW-74761(p.4.1-47))
URANIUM OXIDES
analysis of, for uranium, 17: 5957 (PG-Report-294)
reactivity of slightly enriched beryllium-oxide-moderated, studies using pulsed neutron source, 17: 7535 (CEA-2201)
UO_2–ZrO_2, fabrication of, 17: 6511(R) (BMI-1593(Del.))
URANIUM OXIDES (CLAD)
fission-gas release from, 17: 6645 (BMI-1604)
URANIUM OXIDES (STAINLESS STEEL CLAD)
thermal cycling effects on, 17: 6513 (GEAP-4069)
URANIUM OXIDES (Zr ALLOY CLAD)
development of, for use in heavy water reactors, 17: 7597(R) (DP-785)
radiation effects on aluminum encapsulated, 17: 6739 (CVNA-153)
URANIUM(IV) OXIDES
chlorination, 17: 6192(T,R) (EURAEC-382)
deposition with plutonium dioxide, 17: 7550(R) (HW-74761(p.6.1-20))
electric conductivity and Hall effect in, 17: 6536(T,R) (EURAEC-365)
electron diffraction by double layers of, 17: 6728
fabrication of pellets of, by sintering, 17: 5656(R) (KR-29)
fission-gas release from, during irradiation, 17: 6511(R) (BMI-1593(Del.))
heat conductivity of swaged, 17: 6601(T,R) (EURAEC-372)
oxidation kinetics, 17: 6192(T,R) (EURAEC-382)
preparation of colloidal, in ammonia, 17: 6123(R) (AGN-AN-756)
radiation effects, 17: 7548(R) (HW-74761(p.4.1-47))
radiation effects on, 17: 6742 (HW-SA-2309)
radiation effects on, thermal neutron, 17: 6755
reactions with graphite, 17: 6106
separation from plutonium by electrolytic deposition in salt cycle process, 17: 7550(R) (HW-74761(p.6.1-20))
swaging of, 17: 6601(T,R) (EURAEC-372)
thermal conductivity of, measurement of, 17: 6523(R) (NUMEC-P-51)
Al_2O_3–UO_2, effects of thermal neutron irradiation on, 17: 6755
BeO–UO_2, effects of thermal neutron irradiation on, 17: 6755
MgO–UO_2, preparation for irradiation tests, 17: 6536(T,R) (EURAEC-365)
PuO_2–UO_2, electric conductivity, 17: 6536(T,R) (EURAEC-365)
PuO_2–UO_2, fabrication by cold swaging and vibrational compaction, 17: 7547(R) (HW-74761(p.3.1-39))
PuO_2–UO_2, fuel rod development of, 17: 7544 (HW-71232)
PuO_2–UO_2, preparation, 17: 6532(R) (NUMEC-P-51)
PuO_2–UO_2, radiation effects, 17: 6744 (HW-SA-2668)
PuO_2–UO_2, radiation effects, 17: 6745 (HW-SA-2675)
PuO_2–UO_2, sintering, 17: 6512 (CRRM-1111)
ReO_2–UO_2, radiation effects, 17: 6512 (CRRM-1111)
ThO_2–UO_2, processing of irradiated, 17: 6186 (ORNL-TM-420)
UO_2–ZrO_2, radiation effects, 17: 6752 (WAPD-264)
UO_2–ZrO_2, radiation effects on phase changes in, 17: 6753 (WAPD-T-1402)
URANIUM SULFIDES
properties, 17: 6636 (ANL-FGF-247)
sintering, 17: 6636 (ANL-FGF-247)
URANIUM SYSTEMS
book: *Uranium Metallurgy. Vol. II. Uranium Corrosion and Alloys*, 17: 6540
BeO–U, neutron multiplication in, 17: 7131 (NP-12330(p.392-8))
C–Th–U, thermal conductivity of stoichiometric, 17: 6511(R) (BMI-1593(Del.))
F–U, thermodynamics between UF_4 and UF_6, 17: 6106
O–U, thermodynamics between UO_{2+x} and UO_3, 17: 6106
U–ZrH, properties of, 17: 6559
URANYL ACETATE COMPLEXES
formation in aqueous solutions of alkali metal acetates, spectra of, 17: 6081
URANYL NITRATE COMPLEXES
with TBP, spectra in organic solvents, 17: 6081
URANYL NITRATES
analysis of, for uranium, 17: 5957 (PG-Report-294)
precipitation of ammonium diuranate from solutions of, 17: 5935 (CEA-2204)
transfer across interface in butex-aqueous system, 17: 6178 (AERE-R-4091)
URANYL PERCHLORATES
spectra of, in aqueous solutions of alkali metal acetates, 17: 6081
URANYL SULFATES
reduction of, uranium(IV) yield from electrolytic, 17: 6177 (IEA-47)
UREA
determination in body fluids, 17: 6032(P)
radiation effects on electron spin resonance of inclusion compounds of, 17: 6162
URIDYLIC ACID
preparation of oligo-, 17: 5675(R) (LAMS-2780(p.246-317))
URINE
analysis for radioisotopes, bibliography on, 17: 5981 (VDIT-66)
UTERUS
radiosensitivity of cervical tumors, 17: 5869
radiosensitivity of cervical tumors, possibility of increasing, 17: 5870

V

VACUUM FURNACES
design of electron bombardment, for annealing refractory metal samples, 17: 6218
VACUUM SYSTEMS
description of, for evaporative deposition of films, 17: 6158
design and operation of, for ZGS injector, 17: 7339 (BNL-6511(p.318-22))
VACUUM VESSELS
degasification of, development of flame-sprayed ceramic-metal heating element for acceleration of, 17: 6205 (CERN-62-28)
VAGINA
cytology, in evaluation of effectiveness of radiotherapy of gynecologic cancer, 17: 5864
VALINE
analysis for carbon-14 by continuous scintillation counting, 17: 5709
VALVES
design of fast, for injection of gas into vacuum, 17: 6216
development for liquid metal cooled reactors, 17: 7606(R) (ORNL-1515)
VAN ALLEN RADIATION BELTS
boundary of inner, 17: 6934(T)
boundary of outer, 17: 6936(T)
Cape Town anomaly in, effect on auroral emission, 17: 6850
charged particle intensity in, 17: 6935(T)
detection in South Atlantic magnetic anomaly, 17: 6937(T)
electron diffusion in, high mirror point, 17: 6294
electron diffusion in, low mirror point, 17: 6925
electron diffusion in, 17: 6930
electron diffusion in, 17: 6941
electron injection by Argus tests, 17: 6839
hydromagnetic waves in outer, 17: 6926
proton flux and energy measurements, 17: 6920
proton trapping mechanism, 17: 6921
VAN DE GRAAFF ACCELERATORS
energy modulation in 3.6-Mv, 17: 7307 (BNL-5792)
VANADIUM
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
deuteron reactions (d,t) at 21.6 Mev, 17: 6780(R) (ANL-6603(p.52-5))
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
separation from metallic mixture by ion exchange chromatography, 17: 5991
VANADIUM ALLOYS

Al–Ti–V, stress-corrosion, 17: 6569(R) (NP-12369)
Fe–V–Zr, corrosion by steam at 750°F, 17: 6561(R) (ARF-2198-34)
Mo–U–V, properties and structure, 17: 6725
Nb–Ta–V, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Nb–Ti–V, protective coatings for, 17: 6562(R) (AkF-B-6001-1)
Ni–Nb–V, oxidation of coatings of, 17: 6562(R) (ARF-B-6001-1)
V–Zr, extrusion of, effects on structure, 17: 6654(R) (EURAEC-394)
VANADIUM ISOTOPES
decay scheme, 17: 7138 (PUC-1962-61)
VANADIUM ISOTOPES V-48
energy level at 305 kev, lifetime of, 17: 6958 (UCRL-7091)
VANADIUM ISOTOPES V-51
proton reactions (p,n), cross section relations with energy, 17: 7144 (TID-17357(Pt.III))
VANADYL IONS
analytical use as back-titrant in determination of metals in fluoride solutions, 17: 5995
VAPORIZATION
symposium on, of nuclear materials, 17: 6104
VEHICLES
trolley for support of scintillation counters, 17: 6213
VELA PROJECT
seismic measurements of DANNY BOY shot in, 17: 6268 (NP-12419)
seismic measurements of Hyrax event in, 17: 6269 (NP-12420)
seismological data in, for AARDVARK shot, 17: 6267 (NP-12328)
VERMICULITES
mitigation of shock wave effects by lightweight concrete containing, 17: 5668 (DASA-1263)
VINYL COMPOUNDS
radioinduced polymerization, effects of dose rate, 17: 6175
VIRUSES
molecular structures of adeno-, 17: 6792(R) (ISS 62/14)
radiation effects on spread of tick-borne encephalitis, in lymphatic system in mice, 17: 5786
VISCOMETERS
design of, for liquid metals, 17: 6671 (NP-12366)
VISCOSITY
of liquid metals, design of viscometer for measuring, 17: 6671 (NP-12366)
VISION
radiation effects on receptor apparatus of, in man, 17: 5851
VITAMIN B
content in irradiated pork, effects of moisture, 17: 6365
VITAMIN B_{12}
absorption, tracer study using whole-body counting, 17: 5746
VOLTMETERS
standardization of, 17: 6395 (HW-SA-2510)

W

WASPALOY
drilling, 17: 6615
WASTE DISPOSAL
regulations in Germany, 17: 7654
to deep wells and salt formations, development of techniques for, 17: 7653(R) (ORNL-TM-396)
WASTE PROCESSING
by calcination, development of processes for high-level materials, 17: 7653(R) (ORNL-TM-396)
materials by ion exchange scavenging, low-level, 17: 7653(R) (ORNL-TM-396)
research programs on calcination, extraction, and sorption techniques for, 17: 7652(R) (HW-75290)
scavenging of NPR decontamination solutions, 17: 7651 (HW-74507)
WASTE SOLUTIONS
disposal of, in uranium milling, 17: 7650 (BM-RI-6114)
WATER
analysis for oxygen-17 and oxygen-18, 17: 5956 (KR-30)
burnout conditions for flow of boiling, in vertical round ducts, 17: 7528 (AE-87)
decompression of, in reactors, 17: 7532(R) (ARF-K6018-3)
determination of, in powders of metals and metal compounds by vacuum distillation, 17: 5963 (PG-Report-350)
meson (π^-) capture by hydrogen in, 17: 7083 (JINR-P-1081)
neutron rethermalization in, 17: 7055 (HW-SA-2415)
radioisotope levels in tap, 17: 5751(R) (HASL-132)
steam–water, flow patterns of, two-phase, 17: 7613(R) (UNC-5042)
steam-water, specific gravity in boilers, 17: 6378
thermodynamic functions for, at −10 to 1000°C and 1 to 250,000 bars, 17: 6055 (UCRL-7118)
thermodynamic similarity with water-d_2, 17: 6059(T) (CEA-tr-R-1541)
transfer to water-d_2 by hydrated solutions of electrolytes, 17: 6096
WATER-d_2
diffusion of thermal neutrons in, at 20 to 220°C, 17: 7058 (TID-15165)
proton exchange with ribonuclease, nuclear magnetic resonance spectra of, 17: 6073
removal of, from heavy water reactors, 17: 7588(P)
thermodynamic similarity with light water, 17: 6059(T) (CEA-tr-R-1541)
transfer to light water by hydrated solutions of electrolytes, 17: 6096
WATER COOLED REACTORS
boiling effects on power and reactivity in, 17: 7574 (WAPD-T-1225)
corrosion of materials in high-temperature, 17: 6567 (HW-SA-2745)
WATER MODERATED REACTORS
boiling effects on power and reactivity in, 17: 7574 (WAPD-T-1225)
WATER SUPPLIES
analysis for radioactivity, spectrometric, 17: 5733
radioactivity in British, 17: 6337
WAXES
use of, as laps on vibratory polishers, 17: 6516 (IS-439)
WELDING
development for reactor materials, 17: 7606(R) (ORNL-1515)
of steel plates, electroslag vertical, 17: 6602(T,R) (EURAEC-392)
WELDING RODS
radiation effects, 17: 6735 (AE-90)
stress-rupture properties of high-nitrogen, 17: 6723
WELDS
ultrasonic inspection of, in thick wall steel pipe, 17: 6243 (HW-74597)
WELL LOGGING
radiation protection in, 17: 6342
WHEAT
radiosensitivity and cytological changes in, effects of variety on, 17: 5903
strontium-90 levels in, 17: 5751(R) (HASL-132)
WHITE OAK CREEK
monitoring of, for radionuclides, 17: 7653(R) (ORNL-TM-396)
WIND
covariance, directional component means, and variances of, for 5 years, tabulation by season for 9 locations, 17: 6251 (CDRP-182-109)
WINDOWS
brazing of thin beryllium, to supports, 17: 6605
design of zinc bromide-filled shielding, 17: 7498 (USNRDL-TR-594)
WIRES
distortion of helical wrappings of, on reactor fuel rods, 17: 6743 (HW-SA-2445)
explosion of, destructive effects of plasma from, 17: 7495
WOOD
stress analysis of, 17: 7532(R) (ARF-K6018-3)

X

X RADIATION
biological effects on embryonal development of mice, 17: 5897
biological effects, effects of dose on recovery rate, 17: 5909 (TID-14019)
biological effects on swimming times of rats, 17: 5934
biological effects in mice and hamsters, 17: 5779(R) (UCSF-22)
biological effects on skin, 17: 5813
biological effects in mice, 17: 5671(R) (LAMS-2780(p.85-129))
conditioned avoidance to, in rats, 17: 5837
effectiveness in treatment of tumors, 17: 5779(R) (UCSF-22)
effects of frequent exposure of chest on incidence of leukemia, 17: 5816
effects of protracted low-level ancestral exposure of mice to, on sensitivity to gamma radiation, 17: 5777 (TID-15181)
effects on anaphylactic reactions in guinea pigs, whole-body exposure,

17: 5783
effects on biological and structural properties of hemic cells *in vitro*, 17: 5862
effects on bone marrow cells in atomic bomb survivors, 17: 5785
effects on brain function, whole-body exposure, 17: 5886
effects on brain function, whole-body exposure, 17: 5888
effects on brain lipid metabolism, whole-body exposure, 17: 5882
effects on caudal regeneration in *Syllis amica*, 17: 5808
effects on cells, tumor-growth, 17: 5824
effects on central nervous system, exposure of head, 17: 5887
effects on cholesterol and fatty acid synthesis in liver in rats, 17: 5792
effects on competence of gastrula ectoderm in batrachia, 17: 5807
effects on denaturation of desoxyribonucleic acid extracted from *Escherichia coli*, 17: 5855
effects on development of transplanted tumors in rats, whole-body, 17: 5860
effects on development of planaria, 17: 5789
effects on erythrocyte creatine content, 17: 5856
effects on experimental allergic encephalomyelitis in guinea pigs, 17: 5801
effects on fatty acid composition of skin lipids, 17: 5825
effects on female genital organs, whole-body exposure, 17: 5795
effects on glycolysis hindrance in ascites tumor cells, 17: 5900
effects on gonads of immature female rats, 17: 5838
effects on hepatic regeneration, whole- and partial-body exposure, 17: 5854
effects on histology and function of kidneys in rabbits, 17: 5904
effects on hypertensive damage in blood vessels, 17: 5844
effects on jaws and teeth in rats, 17: 5867
effects on lipid composition of liver mitochondria in rats, 17: 5772 (TID-13322)
effects on morphology of granulocytes, whole-body exposure, 17: 5797
effects on morphology of granulocytes, whole-body exposure, 17: 5798
effects on nitrogen metabolism in yeast, 17: 5881
effects on oxidative phosphorylation of isolated liver mitochondria in rats, 17: 5784
effects on peroxidase activity of granulocytes, 17: 5811
effects on polysaccharide metabolism, whole-body exposure, 17: 5828
effects on quinone content of tissues, 17: 5880
effects on rate of vegetative fission in Paramecium, 17: 5778 (TID-15521)
effects on receptor apparatus of cutaneous and visual analyzers in man, 17: 5851
effects on response of rats to barbiturates, whole-body exposure, 17: 5788
effects on spread of tick-borne encephalitis in lymphatic system in mice, 17: 5786
effects on yeast cells, protective effects of tetrahydrooxyquinone and neighboring compounds against, 17: 5919
effects on young oocytes in mice, 17: 5835
genetic effects in barley, synergistic effects of ethylmethane sulfonate, 17: 5861
genetic effects in *Chondrococcus columnaris*, 17: 5769 (HW-SA-2540)
genetic effects in yeast, 17: 5809
genetic effects on prolan stimulation of ovaries, 17: 5817
induction of breast tumors in rats, 17: 5839
isodoses of, from 15.5-Mev betatron, effects of field size on, 17: 5899
lethal effects, protective effects of olive oil, 17: 5859
metabolic effects, protective effects of cysteamine, 17: 5858
neurological effects on electroencephalographic changes in brain, 17: 5902
pathological effects on eye, 17: 5794
perception by rats, physiological receptor mechanisms of, 17: 5857
production in theta pinch discharges, 17: 7478
protection from, in laboratories, 17: 6319 (TID-15445)
scattering by acridine III, 17: 6062
sorption of soft, by psoriatic parakeratotic stratum corneum, 17: 5689
transmission by imperfect silicon crystals, 17: 6064
transmission by perfect silicon crystals, abnormal, 17: 6063

X-RAY BEAMS
dosimetry at edge of, effects of ionization chamber size on, 17: 6445

X-RAY CAMERAS
design of pinhole, for use in dentistry, 17: 5688

X-RAY DIFFRACTOMETERS
shield design for, 17: 6220

X-RAY EQUIPMENT
shielding of dental, 17: 6344

X-RAY SPECTROMETERS
performance of p-n junctions as, 17: 6458

XANTHYDROL
analytical use of labeled, in urea determination, 17: 6032(P)
preparation of carbon-14 labeled, 17: 6032(P)

XENON
meson (π^-) reactions in liquid, meson (K^0) pair production in, 17: 7039

XENON IONS
reactions with copper, gold, and graphite at 100 to 30,000 ev, yields of secondary ions from, 17: 7268

XENON ISOTOPES
half life, 17: 7194

XENON ISOTOPES Xe-131
gamma spectrum of, low-energy, 17: 7142 (TID-15548)

XENON ISOTOPES Xe-133
release from metal-clad uranium dioxide, 17: 6645 (BMI-1604)

XENON ISOTOPES Xe-135
release from metal-clad uranium dioxide, 17: 6645 (BMI-1604)

XYLENE
behavior of pyrene in para, effects of concentration on, 17: 5938 (TID-13249)
radiolytic oxidation of *p*-, 17: 6143

Y

YEASTS
physiological effects of tritiated water on *Rhodotorula gracilis*, effects of cystamine, 17: 5719
radiation effects on nitrogen metabolism, 17: 5881
radiation effects on, protective effect of tetrahydrooxyquinone and neighboring compounds against, 17: 5919
radioinduced mutant, 17: 5809

YTTERBIUM
determination in EDTA complexes, spectrophotometric, 17: 6010
determination in minerals and rocks, spectrographic, 17: 6008
determination in rare earth oxides, 17: 6019
neutron cross sections at 0.015 to 0.3 ev, 17: 7078 (IEA-51)
separation from yttrium group, 17: 6019

YTTERBIUM ACETATES
preparation of anhydrous, by desolvation, 17: 6082

YTTRIUM
determination in minerals and rocks, spectrographic, 17: 6008
determination in soil and rocks, 17: 6019
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
separation from chloride solutions by solvent extraction using mono-2-ethyl hexyl phosphoric acid, synergistic effects in, 17: 6188 (TID-15271)
separation from lanthanum and neodymium, effects of solvent mixture on chromatographic, 17: 6009

YTTRIUM ACETATES
preparation of anhydrous, by desolvation, 17: 6082

YTTRIUM ALLOYS
Al–Cr–Y, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)
Co–Y, magnetic structure of, 17: 6706
Cr–Fe–Y, fission-product permeability at 2200 to 3200°F, 17: 6645 (BMI-1604)

YTTRIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007

YTTRIUM ISOTOPES Y-88
decay of isomers of, 17: 7294
positron decay, 17: 7254

YTTRIUM ISOTOPES Y-90
beta activity of, design of 4π beta plastic scintillator for measurement of, 17: 6459
determination in solution using scintillation detector, 17: 6446

pathological effects of ingested in fish, 17: 5701 (HW-SA-2255)
radiotherapy using, interstitial, 17: 5695
YTTRIUM SILICATES
preparation of colloidal, for use as beta emitter, 17: 5656(R) (KR-29)

Z

ZINC
corrosion, 17: 6572 (OTS-61-31480)
determination in uranium, spectrophotometric, 17: 6001
determination in zirconium alloys, 17: 6020
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
mesic atom (μ^-) decay in, anomaly in, 17: 6888
neutron scattering by, in beta brass, 17: 6705
radiation effects on electric resistance of, 17: 6732 (62-GC-207)
radiation effects on, 17: 6733 (62-GC-209)
recrystallization of, by thermal cycling, 17: 6698(T) (NP-tr-929)
superconductivity of, energy gap and critical field in, 17: 6877
ZINC ALLOYS
reactions with uranium for separation from spent fuels, 17: 6184 (NBS-7582)
Nb–Zn, superconductivity of, critical persistent currents in, 17: 6875
Sn–Zn, entropy of liquid, electronic contribution in mixing to, 17: 6044 (NP-12311)
ZINC BROMIDES
use in shielding windows, 17: 7498 (USNRDL-TR-594)
ZINC COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007
ZINC ISOTOPES Zn-65
accumulation in aquatic insects, 17: 5702 (HW-SA-2848)
gamma specific emission coefficient, 17: 6431 (CEA-2036)
metabolism in man, 17: 5670(R) (LAMS-2780(p.17-84))
ZINC ISOTOPES Zn-68
neutron reactions (n,γ), cross sections for, 17: 7100 (NP-12330(p.95-6))
ZINC ISOTOPES Zn-69
isomeric-pair production by neutron activation, yield ratios of, 17: 7248
ZINC SULFATES
transfer between heavy and light water, ionic hydration in, 17: 6096
ZINC SULFIDE CRYSTALS
fluorescence properties of, 17: 6092
ZIRCALOY-2
analysis for boron by direct absorptiometric method, 17: 5965 (PG-Report-362)
cladding thickness testers for, 17: 6391 (DP-663)
corrosion by steam and water, 17: 6581
corrosion by water at 680°F and by steam at 750°F, 17: 6561(R) (ARF-2198-34)
creep at 550 to 750°F, 17: 6511(R) (BMI-1593(Del.))
mechanical properties of, hydrogen effects on, 17: 6696(T) (EURAEC-353)
performance as reactor pressure tube material, 17: 7552(R) (HW-74761 (p.8.1-15))
phase composition in, determination of second, 17: 6719
radiation effects on creep, 17: 7553(R) (HW-74761(p.9.1-37))
radiation effects, 17: 6735 (AE-90)
sorptive properties for hydrogen beyond terminal solubility, 17: 7552(R) (HW-74761(p.8.1-15))
stresses in, effects of hydrogen embrittlement on, 17: 7555(R) (HW-74761(p.11.1-14))
tensile properties of, prediction of, 17: 6691 (WAPD-T-1335)
testing of, development of equipment for, 17: 7555(R) (HW-74761 (p.11.1-14))
welding for corrosion-resistant joints, 17: 6630
BC–Zircaloy-2 dispersion, remote preparation of irradiated metallographic specimens of, 17: 6526 (TID-7625(p.20-9))
ZIRCALOY-3
phase composition in, determination of second, 17: 6719
ZIRCONIUM
analysis, 17: 6020
analysis for boron by direct absorptiometric method, 17: 5965 (PG-Report-362)
analysis for iron, 17: 5946 (AERE-AM-91)
analysis of, for boron, 17: 5970 (PG-Report-391)
chemical behavior in acid and aqueous solutions, 17: 6097
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
corrosion of, effects of gases on, 17: 6020
corrosion of, effects of hydrogen on, 17: 6585
deposition on plutonium–zirconium alloys, 17: 7547(R) (HW-74761 (p.3.1-39))
determination, chromotographic and photometric, 17: 6020
determination in fluorides by titration with EDTA, use of vanadyl ion as back-titrant in, 17: 5995
determination in molybdenum and tungsten by solvent extraction using cupferron, 17: 6012
determination in nickel steel and electro-etch residues, activation, 17: 5984
determination in presence of hafnium, titrimetric, 17: 6002
determination in tantalum, photometric, 17: 6022
determination in uranium, volumetric, 17: 7606(R) (ORNL-1515)
determination of, by precipitation of labeled on watch glass and counting, 17: 5952 (IA-772)
determination using chlorphosphonazo III, photometric, 17: 6016
diffusion of nitrogen in, relation to internal friction, 17: 6724
dissociation energy of gaseous and heat of vaporization of solid, correlation of, 17: 6095
ductility of, effects of hydrogen on, 17: 7609(R) (SRO-75)
effects of additions of, on extrusion and forging of molybdenum alloys, 17: 6589 (ASD-TDR-62-670)
effects of additions of, on extrusion and forging of molybdenum–tungsten alloys, 17: 6589 (ASD-TDR-62-670)
electric conductivity of, temperature effects on, 17: 6814(T) (UCRL-Trans-887(L))
extrusion of, effects on structure, 17: 6654(R) (EURAEC-394)
gamma pair production cross sections for, 17: 7116 (NP-12330(p.186-92))
hydriding procedures for massive, 17: 6649 (DC-61-7-26)
in-pile corrosion, 17: 6565(R) (EURAEC-413)
neutron polarization in, measurement as function of scattering angle, 17: 7065
plastic deformation of, mechanisms in, 17: 7609(R) (SRO-75)
separation from hafnium by solvent extraction, 17: 6020
separation from metallic mixture by ion exchange chromatography, 17: 5991
separation from niobium by solvent extraction using selenious acid, 17: 6022
surface properties of, studies by field-emission microscopy, 17: 6634 (AFOSR-2273)
ZIRCONIUM ALLOYS
analysis, 17: 6020
analysis for iron, 17: 5946 (AERE-AM-91)
analysis of, for boron, 17: 5970 (PG-Report-391)
corrosion by lithium at 1500 to 1900°F, 17: 6570 (ORNL-2674)
corrosion of, in high-temperature water cooled reactors, 17: 6567 (HW-SA-2745)
oxidation, 17: 6564(R) (DRI-2056)
Al–Nb–Zr, phase studies, 17: 6729
Al–Nb–Zr, preparation, 17: 6652(R) (DRI-2057)
Al–Zr, phase studies, 17: 6729
Be–Zr, oxidation, 17: 6643(R) (BBC-112)
Be–Zr, oxidation, 17: 6653(R) (DRI-2071)
Cr–Fe–Zr, corrosion by steam at 750°F, 17: 6561(R) (ARF-2198-34)
Cr–Fe–Zr, corrosion of, oxygen gradients in, 17: 6579
Cr–Ni–Zr, corrosion of, oxygen gradients in, 17: 6579
Cr–Zr, corrosion by water at 680°F, 17: 6561(R) (ARF-2198-34)
Cr–Zr, corrosion by steam at 750°F, 17: 6561(R) (ARF-2198-34)
Cr–Zr, strength, 17: 6561(R) (ARF-2198-34)
Cu–Mo–Zr, analysis for boron by direct absorptiometric method, 17: 5965 (PG-Report-362)
Fe–Sn–Zr, structures in, 17: 6527 (TID-7625(p.30-41))
Fe–V–Zr, corrosion by steam at 750°F, 17: 6561(R) (ARF-2198-34)
Ga–Ge–Zr, phase studies, 17: 6729
Ga–Nb–Zr, phase studies, 17: 6729
Mo–Nb–W–Zr, fabrication and properties of rolled sheet, 17: 6597(R)

(DMIC-176)
Mo–Ti–Zr, fabrication of rolled sheet, 17: 6597(R) (DMIC-176)
Mo–Ti–Zr, phase studies, 17: 6668(R) (NMI-9246)
Mo–Ti–Zr, powder metallurgy, 17: 6668(R) (NMI-9246)
Mo–Ti–Zr, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Mo–Zr, strength of, effects of carbon additions on, 17: 6672 (NP-12383)
Mo–Zr, strength of, effects of boron additions on, 17: 6672 (NP-12383)
Nb–Sn–Zr, corrosion in water and steam, 17: 6535(T) (EURAEC-352)
Nb–Sn–Zr, corrosion by steam and water, 17: 6581
Nb–Sn–Zr, fabrication of tubing of, 17: 6600(T) (EURAEC-354)
Nb–Sn–Zr, mechanical properties of, hydrogen effects on, 17: 6696(T) (EURAEC-353)
Nb–Sn–Zr, phase studies, 17: 6697(T) (EURAEC-358)
Nb–Sn–Zr, welding, 17: 6535(T) (EURAEC-352)
Nb–Zr, corrosion by steam and water, 17: 6581
Nb–Zr, current-carrying capacity in superconducting solenoids, 17: 6209
Nb–Zr, emissivity, 17: 6675(R) (PWA-2128)
Nb–Zr, mechanical properties of, hydrogen effects on, 17: 6696(T) (EURAEC-353)
Nb–Zr, phase strengthening in, 17: 6555
Nb–Zr, radiation effects on superconducting, proton, 17: 6756
Nb–Zr, superconductivity in, 17: 6807 (UCRL-9819)
Nb–Zr, welding of, 17: 6558
Ni–Zr, extrusion of, effects on structure, 17: 6654(R) (EURAEC-394)
Pu–Zr, cladding with zirconium, 17: 7547(R) (HW-74761(p.3.1-39))
Sb–Zr, corrosion by water at 680°F, 17: 6561(R) (ARF-2198-34)
Sb–Zr, strength, 17: 6561(R) (ARF-2198-34)
Ta–W–Zr, phase studies, 17: 6668(R) (NMI-9246)
Ti–W–Zr, properties of wrought, 17: 6672 (NP-12383)
U–Zr, corrosion of, effects of hydrogen on, 17: 6585
V–Zr, extrusion of, effects on structure, 17: 6654(R) (EURAEC-394)
W–Zr, properties of wrought, 17: 6672 (NP-12383)

ZIRCONIUM BORIDES
compact preparation, 17: 6520(R) (NP-12373)
heat capacity, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
reflection spectra, 17: 6520(R) (NP-12373)
$MoSi_2$–ZrB_2, oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)

ZIRCONIUM CARBIDES
compact preparation, 17: 6520(R) (NP-12373)
corrosion by fused fluorides and liquid metals, 17: 7606(R) (ORNL-1515)
electric conductivity, 17: 6520(R) (NP-12373)
flow characteristics of, high-temperature, 17: 6554
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
reactions with hydrogen, 17: 6520(R) (NP-12373)
reactions with hydrogen chloride, 17: 6520(R) (NP-12373)
NbC–ZrC, Hall effect, 17: 6520(R) (NP-12373)
NbC–ZrC, reflection spectra of, 17: 6520(R) (NP-12373)

ZIRCONIUM CHLORIDES
properties of, chemical and physical, 17: 6097

ZIRCONIUM COMPLEXES
with arsenazo III, formation mechanism of, 17: 6007

ZIRCONIUM FLUORIDES
effects on freezing point of sodium fluoride, 17: 6088
BeF_2–LiF–ThF_4–UF_4–ZrF_4, phase studies, 17: 7562(R) (ORNL-3369)
BeF_2–LiF–ZrF_4, phase studies of, 17: 7562(R) (ORNL-3369)
LiF–NaF–ZrF_4, corrosive effects of liquid, on nickel and nickel alloys, 17: 6571 (ORNL-TM-411)
NaF–UF_4–ZrF_4, phase studies, 17: 7606(R) (ORNL-1515)
NaF–UF_4–ZrF_4, thermal capacity at 550 to 850°C, 17: 7606(R) (ORNL-1515)

ZIRCONIUM HYDRIDES
corrosion inhibition by, 17: 7606(R) (ORNL-1515)
production of massive sections of, 17: 6595 (DC-61-7-18)
thermodynamic functions of, calculation from dissociation-pressure data, 17: 6108
U–ZrH, properties of, 17: 6559

ZIRCONIUM ISOTOPES Zr-90
energy level configurations in, doublets from, 17: 7105 (NP-12330 (p.122-5))

ZIRCONIUM ISOTOPES Zr-95
determination in human lungs, whole-body counting, 17: 5704 (TID-12790)
determination of, in stratosphere, 17: 6271(R) (NYO-10464)

ZIRCONIUM MINERALS
preparation and properties of synthetic, 17: 6282

ZIRCONIUM NITRATES
properties of, chemical and physical, 17: 6097

ZIRCONIUM NITRIDES
Hall effect, 17: 6520(R) (NP-12373)
oxidation of, in argon–carbon dioxide mixtures at 2250°C, 17: 6520(R) (NP-12373)
reflection spectra, 17: 6520(R) (NP-12373)

ZIRCONIUM ORES
analysis for uranium, spectrographic, 17: 6013

ZIRCONIUM OXIDES
deterioration of calcia-stabilized, by thermal cycling, 17: 6667 (NASA-TN-D-1595)
electric resistance, 17: 6656 (HW-75501)
phase diagrams, 17: 6579
plasma spraying of, 17: 6556
PuO_2–ZrO_2, fabrication and testing, 17: 7547(R) (HW-74761(p.3.1-39))
UO_2–ZrO_2, radiation effects, 17: 6752 (WAPD-264)
UO_2–ZrO_2, radiation effects on phase changes in, 17: 6753 (WAPD-T-1402)

ZIRCONIUM SILICATES
emissivity, 17: 6675(R) (PWA-2128)
endurance of coating, 17: 6675(R) (PWA-2128)

ZIRCONIUM SYSTEMS
Al–Si–Zr, phase studies, 17: 6729
H–Zr, phase diagrams, 17: 6649 (DC-61-7-26)
O–Si–Ti–W–Zr, oxidation resistance of, testing as tungsten coating, 17: 6519(R) (NP-12293)
O–Zr, thermodynamic properties of, 17: 6111

ZIRCONYL CHLORIDES
chemical behavior in aqueous solutions, 17: 6097

ZIRCONYL NITRATES
chemical behavior in aqueous solutions, 17: 6097

REPORT NUMBER INDEX

All reports, translations, and patents abstracted in this issue are included in this index. Each item is listed by report number; this is followed by the abstract number and a brief notation regarding public availability. The index entries show, when known, which reports are on file in the depository libraries, which reports have been published in open-literature journals (journal citation given), and which reports can be purchased (source and price). Whenever a report is identified by more than one number, cross references from secondary to primary report numbers are cited.

The report number codes apply to AEC reports unless designated otherwise. Non-AEC reports are identified by parenthetical notes after the report codes; e.g., (non-AEC), (British), (Canadian), (French). The note (Misc.) identifies those codes used for both USAEC and non-AEC reports. The report numbers for the non-AEC reports in these series are marked with an asterisk (*). Patents are listed under the heading "PATENTS"; the country of origin is included in parentheses.

A comprehensive listing of both AEC and non-AEC report codes is contained in TID-85(2nd Rev.), *Report Number Series Used by the Technical Information Service in Cataloging Reports*. March 1960, $2.75 (OTS), and supplement, August 1960, $0.50 (OTS).

Public Availability of USAEC Reports

All USAEC reports abstracted in *NSA* are available to the public through one or more of the following sources:

(1) Depository libraries in the United States, in other countries, and in international agencies. A list of these depositories, many of which have facilities for preparing photocopy for sale, appears on the inside covers of each issue of *NSA*.

(2) Scientific and technical journals or other publications.

(3) Microcard Editions, Inc., in Microcard form. Orders and inquiries should be sent to: Accounting and Shipping Department, West Salem, Wisconsin.

(4) Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., for sale as full-size printed copy, photostat or facsimile (Xerox), and microfilm.

(5) Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for sale as full-size printed copy.

Public Availability of Non-AEC Reports

U. S. Reports. Many reports of U. S. Government agencies other than the AEC can be obtained by the public in the same manner as AEC reports. The availability of these reports is given when known. If availability is not shown, inquiries should be directed to the Office of Technical Services. Inquiries concerning "NP" reports should be by title and author rather than by NP number.

Non-U. S. Reports. Many reports of atomic energy establishments of other countries are placed in the depository libraries in the United States, where they are available for public use. Other reports appear in the journal literature. Some British reports are sold by the British Information Service, 45 Rockefeller Plaza, New York 20, N. Y. Some Canadian reports are sold by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada. This index identifies any type of public availability known to the USAEC.

Abbreviations Used in Availability Column

AECL	For sale by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada.
BIS	For sale by the British Information Service, 45 Rockefeller Plaza, New York 20, N. Y.
Dep.	AEC reports: Full-size copy is on deposit in the depository libraries both in and outside the United States. These reports are also for sale by Microcard Editions, Inc., Accounting and Shipping Department, West Salem, Wisconsin. Non-AEC reports: Full-size copy on deposit in the depository libraries in the United States only.
Dep.(mc)	Same as for Dep., except copy is in Microcard form.
DSIR	For sale by the Department of Scientific and Industrial Research, Lending Library Unit, 20 Chester Terrace, London, N. W. 1, England.
DTI Extension	Available from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee.
GPO	For sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C.
HMSO	Her Majesty's Stationery Office, London.
IAEA	Available from the International Atomic Energy Agency.
JCL	For sale by the Special Libraries Association Translation Center, John Crerar Library, 86 E. Randolph Street, Chicago 1, Illinois.
NRC	For sale by the National Research Council of Canada, Ottawa, Ontario, Canada.
OTS	For sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C.
USGS	Available free-of-charge from the U. S. Geological Survey, Washington 25, D. C.

(The symbols "ph," "mf," and "fs" are used to designate that copy is available only in photostat, microfilm, or facsimile (Xerox) form.)

Report No.	Abstract No.	Availability
NUMERICAL	**(Misc.)**	
61-RL-2501G (Rev.)*	17-6379	
62-GC-207*	17-6732	$4.60(OTS)
62-GC-209*	17-6733	$1.60(OTS)
A-AC–	**(Misc.)**	
82/G/L.784	17-5907	19p. of "Strontium 90 Induced Bone and Bone-Marrow Changes. An Experimental Study with Special Reference to the Histogenesis and Histopathology of Osteosarcomas." Uppsala, Almqvist and Wiksells Boktryckeri AB, 1962
AAEC-E–	**(Australian)**	
98	17-6560	Dep.(mc)
99	17-6734	Dep.(mc)
AAEC-TM–	**(Australian)**	
158	17-6380	Dep.(mc)
ACNP–		
62018	17-7595	Dep.(mc); $3.60(fs), $1.28(mf) OTS
62574	17-7596	Dep.(mc); $18.00(fs), $8.66(mf) OTS
AD–	**(Misc.)**	
254402*	17-6381	$1.60(fs) OTS
259044*	17-6043	See NP-12310
267410*	17-6411	See WADD-TR-60-371
274001*	17-5765	See AFCRL-62-244
274129*	17-5668	See DASA-1263
274294*	17-5666	$8.10(OTS)
274301*	17-7497	See DRCL-364
274645*	17-7424	See DCAS-TDR-62-42
274831*	17-6633	OTS
274920*	17-7419	$6.60(OTS)
275005*	17-7420	$9.10(OTS)
275262*	17-5770	See MDC-TDR-62-3
275509*	17-6774	See AFCRL-531(I)
275733*	17-6788	See EDR-2791
276005*	17-6771	$2.25(OTS)
276039*	17-5762	$1.10(OTS)
276092*	17-7642	$2.60(OTS)
276094*	17-7538	See DCAS-TDR-62-44
276119*	17-6302	$3.60(OTS)
276121*	17-6303	$1.60(OTS)
276140*	17-6112	See AFOSR-2541
276213*	17-6789	See ERDL-1704-RR
276362*	17-7421	See AFCRL-62-186
276577*	17-6042	See NOL-TR-62-34
276597*	17-6772	$8.10(OTS)
276651*	17-6732	See 62-GC-207
276652*	17-6733	See 62-GC-209
276727*	17-6634	See AFOSR-2273
276906*	17-6403	See RADC-TDR-62-254
282435*	17-6044	See NP-12311
287085*	17-5908	See SAM-TDR-62-68
288127*	17-6597	See DMIC-176
288671*	17-6259	See NP-12279
288672*	17-6263	See NP-12283
277144*	17-7434	See UTIA-REV-18
288673*	17-6264	See NP-12284
288680*	17-6262	See NP-12282
288899*	17-6260	See NP-12280
288900*	17-6261	See NP-12281
288914	17-6324	See USNRDL-TR-582
289059*	17-5780	See USNRDL-TR-583
289280*	17-7427	See NP-12296
290069*	17-6518	See NP-12288
290094*	17-6669	See NP-12295
290222*	17-6522	See NRL-Memo-1361
290273*	17-6590	See ASD-TDR-62-700
290359*	17-7075	See AROD-2577:2
290544*	17-5753	See NRL-5850
290780*	17-6797	See PIBAL-753
290786*	17-6783	See BSD-TDR-62-337
291054*	17-5676	See SAM-TDR-62-99
291212*	17-6442	See USNRDL-TR-592
291235*	17-6441	See USNRDL-TR-581
291480*	17-6123	See AGN-AN-756
291495*	17-6307	See CDRP-182-112
291501*	17-6251	See CDRP-182-109
291513*	17-6562	See ARF-B6001-1
291585*	17-7498	See USNRDL-TR-594
292124	17-6443	See USNRDL-TR-598
292258*	17-6651	See DMIC-178
292318*	17-6045	See RAD-SR-62-251
292939*	17-7428	See NP-12342
293999*	17-6510	See ASD-TDR-62-934
294300*	17-7610	See SY-5396-R2
AE–	**(Swedish)**	
80	17-5763	Dep.(mc)
87	17-7528	Dep.(mc)
90	17-6735	
AEC-tr–		
5226	17-6962	Dep.; $3.00(OTS)
5259	17-6444	Dep.; $5.00(OTS)
5486	17-6692	Dep.(mc); $5.60(fs), $1.76(mf) JCL
5544	17-6693	Dep.(mc); $4.60(fs), $1.52(mf) JCL
5552	17-6057	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5564	17-7435	Dep.(mc); $4.60(fs), $1.52(mf) JCL
5565	17-6694	Associated Technical Services, East Orange, N. J.
5566	17-6058	Associated Technical Services, East Orange, N. J.
5567	17-6809	Associated Technical Services, East Orange, N. J.
5568	17-6695	Dep.(mc); $4.60(fs), $1.52(mf) JCL
5574	17-6190	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
AECL–	**(Canadian)**	
1619	17-7536	See CRIO-1115
1620	17-6512	See CRRM-1111
1624	17-6308	See CRER-1098
AEEW-M–	**(British)**	
261	17-7496	Dep.; $0.56(BIS), 4s. (HMSO)
AEEW-R–	**(British)**	
118	17-7054	Dep.; $0.63(BIS), 4s. 6d. (HMSO)
176	17-6241	22p. of "The Effect of Test Section Parameters on Saturation Pool Boiling Burnout at Atmospheric Pressure." Chicago, American Institute of Chemical Engineers, 1962
179	17-7529	Dep.; $1.82(BIS), 13s. 0d. (HMSO)
189	17-7530	Dep.; $0.84(BIS), 6s. (HMSO)
197	17-7531	Dep.; $1.12(BIS), 8s. (HMSO)
AERE-AM–	**(British)**	
91	17-5946	Dep.; $0.16(BIS); 1s. 2d. (HMSO)
AERE-C–	**(British)**	
R-933	17-6178	See AERE-R-4091
AERE-R–	**(British)**	
3334	17-5764	Dep.(mc)
3864	17-6478	IAEA Preprint SM-36/38. To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and

Report No.	Abstract No.	Availability
		Standardization, Harwell, United Kingdom, Dec. 10–14, 1962
4087	17-6765	Phil. Mag. (8), 7: 1861-70(1962)
4091	17-6178	Dep.; $0.70(BIS), 5s. (HMSO)
AFCRL–	**(Non-AEC)**	
531(I)	17-6774	$10.50(OTS)
62-134	17-6732	See 62-GC-207
62-186	17-7421	$11.50(OTS)
62-199	17-6733	See 62-GC-209
62-244	17-5765	$3.60(OTS)
62-295	17-5947	
62-515	17-6736	
62-751	17-6773	OTS
AFOSR–	**(Misc.)**	
2273*	17-6634	$1.60(OTS)
2541*	17-6112	$3.60(OTS)
AFSWC-TDR–	**(Non-AEC)**	
62-3	17-5666	See AD-274294
AGN–	**(Misc.)**	
8069	17-6635	Dep.(mc); $5.60(fs), $2.00(mf) OTS
AGN-AN–	**(Non-AEC)**	
756	17-6123	$15.00(OTS)
AID-Report–	**(Non-AEC)**	
61-34	17-6381	See AD-254402
ANL–		
6532	17-6737	Dep.; $1.00(OTS)
6554	17-7630	Dep.; $0.50(OTS)
6603	17-6775	Dep.; $8.60(fs), $3.02(mf) OTS
6611	17-6782	Dep.; $0.50(OTS)
6628	17-6494	Dep.; $0.50(OTS)
6633	17-6227	Dep.; $2.75(OTS)
ANL-FGF–		
247	17-6636	Dep.(mc); $1.60(fs), $0.80(mf) OTS
300	17-6201	Dep.(mc); $1.10(fs), $0.80(mf) OTS
319	17-6718	J. Nucl. Mater. 7: 99-100(1962)
321	17-6637	Dep.(mc); $2.60(fs), $0.86(mf) OTS
343	17-6638	Dep.(mc); $2.60(fs), $0.95(mf) OTS
367	17-6721	Phys. Rev. 129: 625-9(1963)
382	17-6473	See UAC-6868
APDA–	**(Misc.)**	
149	17-6382	Dep.(mc); $4.60(fs), $1.43(mf) OTS
ARF–	**(Misc.)**	
B6001-1*	17-6562	$1.60(fs) OTS
1213-5*	17-6509	
2198-34	17-6561	Dep.(mc); $1.10(fs), $0.80(mf) OTS
3187-10	17-6304	Dep.(mc); $1.10(fs), $0.80(mf) OTS
ARF-K–		
6018-3	17-7532	Dep.(mc); $4.60(fs), $1.43(mf) OTS
AROD–	**(Misc.)**	
2577:2*	17-7075	
ASD-TDR–	**(Non-AEC)**	
62-230	17-6639	OTS
62-233	17-6738	OTS
62-608(Pt.I)	17-6640	OTS
62-670	17-6589	OTS
62-700	17-6590	$1.50(OTS)
62-734	17-6591	OTS
62-781	17-6592	OTS
62-934	17-6510	
ASD-TR–	**(Non-AEC)**	
7-784(VII)	17-6593	
7-840A(VII)	17-6123	See AGN-AN-756
62-7-634	17-6608	379p. of "Machining Difficult Alloys" Metals Park, Ohio, American Society for Metals, 1962
AWRE-O–	**(British)**	
11/62	17-7422	Dep.(mc)
34/62	17-6242	Dep.(mc)
62/62	17-5948	Dep.(mc)
59/62	17-6641	
63/62	17-6642	Dep.(mc)
BAW–	**(Misc.)**	
1262	17-7627	Dep.; $2.25(OTS)
BBC–		
112	17-6643	Dep.(mc); $3.60(fs), $1.34(mf) OTS
BLG–	**(Belgian)**	
132	17-6644	Dep.(mc)
BM-RI–	**(Misc.)**	
6114*	17-7650	Free(Bureau of Mines)
6146*	17-6033	Free(Bureau of Mines)
BMI–	**(Misc.)**	
1593(Del.)	17-6511	Dep.; $2.00(OTS)
1604	17-6645	Dep.; $0.50(OTS)
BMI-X–		
216	17-6202	Dep.(mc); $1.60(fs), $0.80(mf) OTS
BNL–		
763	17-6430	Dep.; $0.50(OTS)
5412	17-7533	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5517	17-6943	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5528	17-6944	Dep.(mc); $2.60(fs), $0.85(mf) OTS
5538	17-5766	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5559	17-6034	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5648	17-6945	$1.10(fs), $0.80(mf) OTS
5674	17-6646	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5726	17-6946	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5727	17-5767	Dep.(mc); $7.60(fs), $2.36(mf) OTS
5747	17-6647	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5771	17-6557	p.709-27 of "Materials Science and Technology for Advanced Applications." Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962
5792	17-7307	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5798	17-5667	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5801	17-7076	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5814	17-5949	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5820	17-6203	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5838	17-6124	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5850	17-6204	$1.60(fs), $0.80(mf) OTS
5866	17-6383	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5891	17-7534	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5925	17-6763	J. Nucl. Mater. 7: 101-2(1962)
6016	17-6125	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6177	17-6228	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6286	17-7233	Phys. Rev. 129: 434-7(1963)
6303	17-7259	Phys. Rev. 129: 854-62(1963)
6307	17-6862	Phys. Rev. 129: 202-10(1963)
6311	17-7230	Phys. Rev. 129: 374-84(1963)
6312	17-7231	Phys. Rev. 129: 385-7(1963)
6352	17-5746	4p. of "Proceedings of the Eighth Congress of the European Society of

Report No.	Abstract No.	Availability
		Haematology." New York, S. Karger, 1962
6415	17-6174	To be published in TID-7641
6461	17-7641	To be published in TID-7642
6501	17-6305	Dep.(mc); $2.60(fs), $0.86(mf) OTS
6503	17-5699	Dep.(mc); $2.60(fs), $1.01(mf) OTS
6511	17-7308	Dep.(mc); $21.00(fs), $9.75(mf) OTS
BRB–		
66	17-6594	Dep.(mc); $4.60(fs), $1.43(mf) OTS
BSD-TDR–	**(Non-AEC)**	
62-337	17-6783	$4.60(fs) OTS
CDRP–	**(Non-AEC)**	
182-105	17-6306	
182-109	17-6251	$4.60(fs) OTS
182-112	17-6307	$1.60(fs) OTS
182-113	17-5749	
CEA–	**(French)**	
1953	17-6705	Bull. soc. Franc. Mineral. Crist. 85: 57-67 (1962)
2036	17-6431	Dep.(mc)
2129	17-6648	Dep.(mc)
2143	17-6384	Dep.(mc)
2154	17-6252	Dep.(mc)
2171	17-6420	Rev. Franc. Etudes Clin. Biol. 7: 213-15(1962)
2187	17-6385	Dep.(mc)
2190	17-6386	Dep.(mc)
2198	17-6387	Dep.(mc)
2201	17-7535	Dep.(mc)
2204	17-5935	Dep.(mc)
CEA-tr–	**(French)**	
A-1125	17-7575	Dep.(mc); $3.60(fs), $1.22(mf) JCL
A-1161	17-6492	Dep.(mc); $1.10(fs), $0.80(mf) JCL
R-1514	17-6191	Dep.(mc); $2.60(fs), $0.89(mf) JCL or OTS
R-1541	17-6059	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
X-461	17-5982	Dep.(mc); $3.60(fs), $1.19(mf) JCL
X-477	17-6810	Dep.(mc); $1.60(fs), $0.80(mf) JCL
CERN–	**(European Organization for Nuclear Research)**	
62-25	17-7344	Dep.(mc)
62-28	17-6205	Dep.(mc)
62-29	17-6388	Dep.(mc)
62-30	17-6784	Dep.(mc)
62-31	17-6785	Dep.(mc)
62-32	17-6389	Dep.(mc)
CEX–		
59.4.16	17-6253	Dep.; $0.75(OTS)
62.6.1	17-6254	Dep.; $0.30(OTS)
CNAM–	**(Turkish)**	
2	17-7085	See NP-12309
CNEN–	**(Italian)**	
63	17-6698	See NP-tr-929
140	17-6495	Dep.(mc)
CRER–	**(Canadian)**	
1098	17-6308	Dep.; $1.50(AECL)
CRIO–	**(Canadian)**	
1115	17-7536	Dep.; $0.50(AECL)
CRRM–	**(Canadian)**	
1111	17-6512	Dep.; $1.00(AECL)

Report No.	Abstract No.	Availability
CVNA–	**(Misc.)**	
153	17-6739	Dep.(mc); $9.60(fs), $3.80(mf) OTS
D–	**(Misc.)**	
1-82-0211*	17-7423	
DASA–	**(Misc.)**	
1263*	17-5668	$5.60(OTS)
DC–	**(Misc.)**	
61-4-37	17-7537	Dep.(mc); $13.50(fs), $5.93(mf) OTS
61-7-6	17-6563	Dep.(mc); $2.60(fs), $1.07(mf) OTS
61-7-18	17-6595	Dep.(mc); $4.60(fs), $1.43(mf) OTS
61-7-26	17-6649	Dep.(mc); $3.60(fs), $1.19(mf) OTS
61-7-27	17-6596	$2.60(fs), $1.04(mf) OTS
DCAS-TDR–	**(Non-AEC)**	
62-42	17-7424	$3.60(OTS)
62-44	17-7538	$6.60(OTS)
62-133	17-6786	
DM–	**(Misc.)**	
60-310	17-6563	See DC-61-7-6
DMIC–	**(Non-AEC)**	
176	17-6597	$1.25(fs) OTS
177(Vol.I)	17-6650	
178	17-6651	$3.60(fs) OTS
DP–		
198	17-6390	Dep.(mc); $1.10(fs), $0.80(mf) OTS
511	17-6035	Dep.; $1.25(OTS)
663	17-6391	Dep.(mc); $1.60(fs), $0.80(mf) OTS
785	17-7597	Dep.; $0.50(OTS)
DPSPU–		
62-30-5	17-6309	Dep.(mc); $1.60(fs), $0.80(mf) OTS
DRCL–	**(Canadian)**	
364	17-7497	Dep.(mc)
DRI–	**(Misc.)**	
2056	17-6564	Dep.(mc); $2.60(fs), $1.01(mf) OTS
2057	17-6652	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2071	17-6653	Dep.(mc); $2.60(fs), $0.95(mf) OTS
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
DXRL-F–	**(New Zealand)**	
6	17-5750	Dep.(mc)
EANDC(E)–	**(European-American Nuclear Data Committee)**	
36L	17-6787	Dep.(mc)
37L	17-7077	Dep.(mc)
EDR–	**(Non-AEC)**	
2791	17-6788	$4.60(OTS)
EFINS–	**(Misc.)**	
62-11	17-6979	Phys. Rev. 129: 413-26(1963)
62-50	17-6902	Dep.(mc); $8.10(fs), $2.87(mf) OTS
EOS–	**(Non-AEC)**	
2080-IR-2	17-6795	See NP-12317
ERDL–	**(Non-AEC)**	
1704-RR	17-6789	$8.10(OTS)
EURAEC–		
325	17-6533	Dep.(mc); $4.60(fs), $1.55(mf) OTS

Report No.	Abstract No.	Availability
329	17-6534	Dep.(mc); $2.60(fs), $0.98(mf) OTS
352	17-6535	Dep.(mc); $5.60(fs), $1.88(mf) OTS
353	17-6696	Dep.(mc); $3.60(fs), $1.31(mf) OTS
354	17-6600	Dep.(mc); $3.60(fs), $1.25(mf) OTS
358	17-6697	Dep.(mc); $1.60(fs), $0.80(mf) OTS
365	17-6536	Dep.(mc); $1.60(fs), $0.80(mf) OTS
372	17-6601	Dep.(mc); $3.60(fs), $1.19(mf) OTS
377	17-6537	Dep.(mc); $4.60(fs), $1.58(mf) OTS
380	17-6740	Dep.(mc); $1.60(fs), $0.80(mf) OTS
382	17-6192	Dep.(mc); $2.60(fs), $0.95(mf) OTS
384	17-7539	Dep.(mc); $5.60(fs), $1.85(mf) OTS
392	17-6602	Dep.(mc); $4.60(fs), $1.61(mf) OTS
393	17-6248	Dep.(mc); $2.60(fs), $0.89(mf) OTS
394	17-6654	Dep.(mc); $1.60(fs), $0.80(mf) OTS
413	17-6565	Dep.(mc); $1.60(fs), $0.83(mf) OTS
505	17-7613	See UNC-5042
506	17-6568	See NMI-1905
FTD-TT–	**(Non-AEC)**	
62-719	17-6754	OTS
62-771	17-5781	OTS
62-981	17-6811	OTS
62-1181	17-6812	OTS
FXM–	**(Misc.)**	
621	17-7564	See PWAC-89
GA–	**(Misc.)**	
1536	17-6036	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2566*	17-7598	
2749	17-7540	Dep.(mc); $15.00(fs), $6.89(mf) OTS
3067	17-6655	Dep.(mc); $4.60(fs), $1.43(mf) OTS
GAT–		
471	17-5950	Dep.; $0.50(OTS)
GAT-T–		
973	17-6392	Dep.(mc); $1.60(fs), $0.80(mf) OTS
GEAP–	**(Misc.)**	
4047	17-7541	Dep.; $0.75(OTS)
4069	17-6513	Dep.(mc); $3.60(fs), $1.31(mf) OTS
GEMP–		
18A	17-6741	Dep.; $1.00(OTS)
75	17-7542	Dep.; $1.00(OTS)
160	17-7599	Dep.(mc); $8.10(fs), $2.87(mf) OTS
GNE/Phys.–	**(Non-AEC)**	
62-16	17-6314	See NP-12386
GNEC–		
210(Suppl.1)	17-7600	$26.00(fs), $10.44(mf) OTS
254	17-7601	Dep.(mc); $14.00(fs), $6.32(mf) OTS
HASL–		
132	17-5751	Dep.; $3.50(OTS)
HW–		
66899	17-6432	$1.60(fs), $0.80(mf) OTS
70501	17-7543	Dep.(mc); $2.60(fs), $0.98(mf) OTS
71232	17-7544	Dep.; $0.75(OTS)
71354	17-6433	Dep.(mc); $2.60(fs), $0.95(mf) OTS
72304	17-7545	Dep.(mc); $1.60(fs), $0.80(mf) OTS
73155	17-6434	Dep.(mc); $1.60(fs), $0.80(mf) OTS
74507	17-7651	Dep.(mc); $1.60(fs), $0.80(mf) OTS
74597	17-6243	Dep.(mc); $1.10(fs), $0.80(mf) OTS
74761	17-7546	Dep.; $3.50(OTS)
74784	17-6514	Dep.(mc); $3.60(fs), $1.19(mf) OTS
74796	17-5951	Dep.(mc); $1.10(fs), $0.80(mf) OTS
74969	17-5700	Dep.; $0.50(OTS)
75290	17-7652	Dep.; $1.00(OTS)
75501	17-6656	Dep.(mc); $1.60(fs), $0.80(mf) OTS
75725	17-7602	Dep.(mc); $1.10(fs), $0.80(mf) OTS
HW-SA–		
2255	17-5701	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2300	17-6393	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2301	17-6255	Dep.(mc); $2.60(fs), $0.86(mf) OTS
2303	17-5738	Progressive Fish Culturist 24: No. 2, 56-9(1962)
2307	17-6566	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2309	17-6742	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2317	17-6606	Trans. Am. Soc. Metals 54: 785-7(1961)
2337	17-5752	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2405	17-6790	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2411	17-6310	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2414	17-6113	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2415	17-7055	Dep.(mc); $5.60(fs), $1.88(mf) OTS
2420	17-6588	p.199-240 of "Corrosion of Reactor Materials. Vol. I." Vienna, IAEA, 1962
2445	17-6743	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2481	17-6394	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2493	17-5768	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2502	17-5654	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2507	17-7557	Dep.(mc); $2.60(fs), $1.07(mf) OTS
2510	17-6395	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2529	17-7558	Dep.(mc); $2.60(fs), $1.10(mf) OTS
2537	17-6037	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2540	17-5769	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2546	17-5655	Dep.(mc); $1.10(fs), $0.80(mf) OTS •
2550	17-6657	$1.10(fs), $0.80(mf) OTS
2552	17-6496	Dep.(mc); $4.60(fs), $1.64(mf) OTS
2668	17-6744	Dep.(mc); $2.60(fs), $0.86(mf) OTS
2675	17-6745	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2696	17-7056	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2745	17-6567	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2761	17-5665	To be published in Proceedings of 1962 AEC-Contractors Nuclear Materials Management Meeting held in Chicago, Ill., October 3–5, 1962
2769	17-6025	To be published in Proceedings of AEC Contractor Session on Nuclear Material Management, held in Chicago, Ill., October 3–5, 1962
2807	17-6244	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2815	17-5936	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2843	17-6311	Dep.(mc); $2.60(fs), $1.07(mf) OTS
2845	17-6362	To be published in TID-7651, Proceedings of the AEC Symposium on Packaging and Regulatory Standards for Shipping Radioactive Materials, held in Germantown, Md., Dec. 3–5, 1962
2848	17-5702	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2854	17-6256	Dep.(mc); $1.60(fs), $0.80(mf) OTS
IA–	**(Non-AEC)**	
740	17-6179	Dep.(mc)
763	17-6038	Dep.(mc)
768	17-6947	Dep.(mc)
769	17-6180	Dep.(mc)
772	17-5952	Dep.(mc)
780	17-6181	Dep.(mc)
783	17-6182	Dep.(mc)
IDO–		
28560(Vol.I)	17-7603	Dep.; $3.50(OTS)
28560(Vol.II)	17-7604	Dep.; $3.00(OTS)
IEA–	**(Non-AEC)**	
47	17-6177	Dep.(mc)
48	17-5953	Dep.(mc)

Report No.	Abstract No.	Availability
49	17-6126	Dep.(mc)
50	17-6435	Dep.(mc)
51	17-7078	Dep.(mc)
IS–		
272	17-7079	Dep.(mc); $2.60(fs), $0.98(mf) OTS
394	17-6515	Dep.(mc); $4.60(fs), $1.61(mf) OTS
423	17-6183	Dep.(mc); $1.60(fs), $0.80(mf) OTS
424	17-6791	Dep.(mc); $1.60(fs), $0.80(mf) OTS
429	17-6948	Dep.(mc); $1.60(fs), $0.80(mf) OTS
431	17-5954	Dep.(mc); $3.60(fs), $1.31(mf) OTS
433	17-6658	Dep.(mc); $1.60(fs), $0.80(mf) OTS
434	17-6114	Dep.(mc); $1.60(fs), $0.80(mf) OTS
438	17-6257	Dep.(mc); $1.10(fs), $0.80(mf) OTS
439	17-6516	Dep.(mc); $1.60(fs), $0.80(mf) OTS
442	17-6659	Dep.(mc); $1.60(fs), $0.80(mf) OTS
445	17-6039	Dep.(mc); $1.60(fs), $0.80(mf) OTS
462	17-6660	Dep.(mc); $2.60(fs), $0.86(mf) OTS
476	17-6436	Dep., $0.50(OTS)
479	17-6080	J. Electrochem. Soc. 110: 91(1963)
ISS–	**(Italian)**	
62/14	17-6792	Dep.(mc)
JAERI–	**(Japanese)**	
1023	17-7631	
JINR–	**(Russian)**	
1050	17-7037	Zh. Eksperim. i Teor. Fiz., 43: 1554-6 (1962)
1081	17-7083	Dep.(mc)
D-1073	17-6949	Dep.(mc)
P-1024	17-7080	Dep.(mc)
P-1025	17-7081	Dep.(mc)
P-1072	17-7082	Dep.(mc)
P-1090	17-6793	Dep.(mc)
P-1091	17-6951	Dep.(mc)
JPL-TR–	**(Non-AEC)**	
32-222	17-6661	
JPRS–	**(Non-AEC)**	
15345	17-7637	OTS
15871	17-5708	OTS
15872	17-5782	OTS
16072	17-6325	$1.60(OTS or SLA)
16471	17-5911	OTS
16573	17-6603	$9.10(OTS)
JüL–	**(German)**	
67-RE	17-7632	Dep.(mc)
68-RC	17-6040	Dep.(mc)
69-ST	17-6437	Dep.(mc)
71-PP	17-6396	Dep.(mc)
72-PP	17-6397	Dep.(mc)
73-RE	17-7633	Dep.(mc)
74-PC	17-5955	Dep.(mc)
75-RE	17-7634	Dep.(mc)
76-RE	17-7559	Dep.(mc)
K–		
1498	17-6835	J. Chem. Phys. 37: 2004-8(1962)
KR–	**(Norwegian)**	
29	17-5656	Dep.(mc)
30	17-5956	Dep.(mc)
KY–		
423	17-6398	Dep.; $0.50(OTS)
LA–		
2763	17-7084	Dep.; $2.50(OTS)
2768	17-6662	Dep.(mc); $2.60(fs), $0.83(mf) OTS
LADC–		
4189	17-5774	See TID-13984
4581	17-6678	See TID-14508
4906	17-6406	See TID-13148
4912	17-6046	See TID-13145
4955	17-7611	See TID-14495
5055	17-5775	See TID-14529
5102	17-5677	See TID-14613
5118	17-6047	See TID-14535
5134	17-6502	See TID-14532
5135	17-6116	See TID-14533
5161	17-6048	See TID-14538
5170	17-6230	See TID-14550
5191	17-6187	See TID-14598
5217	17-7139	See TID-14799
5260	17-6049	See TID-15183
5268	17-7141	See TID-15182
5269	17-5777	See TID-15181
5315	17-6854	Phys. Rev. 129: 28-36(1963)
5338	17-7250	Phys. Rev. 129: 785-90(1963)
5369	17-6819	Ann. Phys. (N. Y.) 20: 450-63(1962)
5435	17-6502	See TID-14532
LAMS–		
2780	17-5669	Dep.; $4.00(OTS)
2781	17-6041	Dep.; $0.50(OTS)
LNF–	**(Italian)**	
62/73	17-6399	Dep.(mc)
62/75	17-6952	Dep.(mc)
62/89	17-6953	Dep.(mc)
MAB–	**(Non-AEC)**	
188-M	17-6517	
MATT–		
77	17-7425	Dep.(mc); $1.60(fs), $0.80(mf) OTS
92	17-7426	Dep.(mc); $1.60(fs), $0.80(mf) OTS
110	17-6400	Dep.(mc); $3.60(fs), $1.13(mf) OTS
140	17-7471	Phys. Rev. Letters 9: 333-5(1962)
142	17-6401	Dep.; $1.00(OTS)
154	17-6663	Dep.(mc); $1.10(fs), $0.80(mf) OTS
MDC-TDR–	**(Non-AEC)**	
62-3	17-5770	
MND-M–	**(Misc.)**	
2346	17-6664	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3A-2496-II(Add.)	17-7605	Dep.(mc); $5.60(fs), $1.88(mf) OTS
MND-P–		
3016-I	17-7643	Dep.(mc); $4.60(fs), $1.70(mf) OTS
MRL–	**(Non-AEC)**	
126	17-6746	
NAA-SR–		
7140	17-7560	Dep.; $1.25(OTS)
7362	17-7561	Dep.; $0.75(OTS)
7482	17-6665	Dep.; $0.50(OTS)
7637	17-6666	Dep.; $0.50(OTS)
NASA-TN–	**(Misc.)**	
D-1457*	17-7644	$1.00(OTS)
D-1595*	17-6667	$0.75(OTS)
NASA-TT–	**(Non-AEC)**	
F-98	17-7527	167p. of Lietuvos TSR Mokslu Akad.

Report No.	Abstract No.	Availability
		Darbai, No. 3, 1960, $1.75(OTS)
NBS–	**(Misc.)**	
7582	17-6184	Dep.; $0.50(OTS)
NDL-TR–	**(Non-AEC)**	
41	17-6258	
NMI–	**(Misc.)**	
1905	17-6568	Dep.(mc); $1.60(fs), $0.80(mf) OTS
4970	17-6524	See TID-7625
9246*	17-6668	
NOL-TR–	**(Non-AEC)**	
62-34	17-6042	$3.60(OTS)
NP–	**(AEC File No. for Non-AEC Reports)**	
12238	17-6312	
12259	17-6954	Dep.(mc)
12279	17-6259	
12280	17-6260	
12281	17-6261	
12282	17-6262	
12283	17-6263	
12284	17-6264	
12288	17-6518	$8.60(OTS)
12293	17-6519	
12295	17-6669	$14.50(fs) OTS
12296	17-7427	$3.60(OTS)
12297	17-6265	
12298	17-6266	
12303	17-6127	Dep.(mc)
12304	17-6497	
12307	17-6498	
12308	17-6499	
12309	17-7085	Dep.(mc)
12310	17-6043	$1.60(OTS)
12311	17-6044	$5.60(OTS)
12317	17-6795	
12319	17-7086	Dep.(mc)
12328	17-6267	
12330	17-7087	
12330(p.71-8)	17-7097	Phys. Rev., 129: 1350-4(1963)
12332	17-6796	
12342	17-7428	$1.60(OTS)
12349	17-6313	$2.50(OTS)
12350	17-6670	
12364	17-6747	$3.60(ph), $1.13(mf) OTS
12366	17-6671	
12369	17-6569	
12373	17-6520	
12374	17-6245	
12383	17-6672	OTS
12386	17-6314	OTS
12417	17-6521	
12419	17-6268	
12420	17-6269	
NP-tr–	**(AEC File No. for Non-AEC Translations)**	
928	17-7436	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
929	17-6698	Dep.(mc); $2.60(fs), $0.83(mf) JCL
930	17-6813	Dep.(mc); $8.60(fs), $3.20(mf) JCL
NRL–	**(Misc.)**	
5850*	17-5753	$2.60(OTS)
NRL-Memo–	**(Misc.)**	
1361*	17-6522	$3.00(OTS)
NUMEC-P–		
51	17-6523	Dep.(mc); $1.10(fs), $0.80(mf) OTS
NYO–		
3503	17-6723	Welding J. (N.Y.) 41: No. 4, 175-s-81-s (1962)
9720	17-6364	Dep.; $2.50(OTS)
9868	17-6115	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10147	17-6246	Dep.(mc); $7.60(fs), $2.60(mf) OTS
10157	17-6130	See RRL-78T
10325	17-6270	Dep.(mc); $11.00(fs), $4.43(mf) OTS
10464	17-6271	Dep.(mc); $5.60(fs), $1.73(mf) OTS
ORA–	**(Misc.)**	
03041-2-F	17-6751	See TID-17406
ORNL–		
1515	17-7606	Dep.(mc); $12.50(fs), $5.57(mf) OTS
1559	17-6315	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2056	17-6185	Dep.(mc); $4.60(fs), $1.43(mf) OTS
2065	17-6673	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2674	17-6570	Dep.(mc); $16.50(fs), $7.82(mf) OTS
2752	17-7607	Dep.; $2.75(OTS)
3284	17-6316	Dep.; $1.50(OTS)
3340	17-6748	Dep.; $1.50(OTS)
3369	17-7562	Dep.; $2.75(OTS)
ORNL-TM–		
396	17-7653	Dep.(mc); $6.60(fs), $2.15(mf) OTS
405	17-6674	Dep.(mc); $6.60(fs), $2.12(mf) OTS
411	17-6571	Dep.(mc); $4.60(fs), $1.70(mf) OTS
420	17-6186	Dep.(mc); $5.60(fs), $1.88(mf) OTS
438	17-6128	Dep.(mc); $1.10(fs), $0.80(mf) OTS
445	17-5937	Dep.(mc); $1.10(fs), $0.80(mf) OTS
ORO–		
520	17-6272	Dep.(mc); $12.00(fs), $5.24(mf) OTS
OTO–		
58-3	17-6317	Dep.(mc); $4.60(fs), $1.43(mf) OTS
OTS–	**(Misc.)**	
61-31480*	17-6572	$2.75(OTS)
PAN–	**(Polish)**	
308/XVII	17-6129	Dep.
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
911,863	17-7585	
912,204	17-6486	
912,208	17-7586	
912,209	17-7587	
912,226	17-6250	
912,259	17-6769	
912,277	17-6487	
912,335	17-7588	
912,537	17-7589	
912,653	17-6224	
912,659	17-7590	
912,943	17-7591	
912,966	17-7592	
913,051	17-6427	
913,138	17-6428	
913,400	17-6488	
913,411	17-6770	
913,489	17-6489	
913,498	17-6429	
913,515	17-6490	
914,231	17-7593	
PATENTS	**(German)**	
1,083,788	17-6492	See CEA-tr-A-1161
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**

Report No.	Abstract No.	Availability
3,065,159	17-6176	
3,068,035	17-7594	
3,068,071	17-6032	
3,068,162	17-6632	
3,068,164	17-6225	
3,068,309	17-6226	
3,068,359	17-6491	
PATENTS	**(U.S.S.R.)**	
670103/23	17-6117	See SCL-T-446
PG-Report–	**(British)**	
294	17-5957	Dep.
306	17-5958	Dep.
329	17-5959	Dep.; $0.25(BIS), 1s. 9d. (HMSO)
337	17-5960	Dep.; $0.56(BIS), 4s. Od. (HMSO)
340	17-5961	Dep.
345	17-5962	Dep.; $0.25(BIS), 1s. 9d. (HMSO)
350	17-5963	Dep.; $0.21(BIS); 1s. 6d. (HMSO)
356	17-5964	Dep.; $0.25(BIS), 1s. 9d. (HMSO)
362	17-5965	Dep.; $0.25(BIS); 1s. 9d. (HMSO)
364	17-5966	Dep.; $0.25(BIS); 1s. 9d. (HMSO)
381	17-5967	Dep.; $0.42(BIS); 3s. (HMSO)
385	17-5968	Dep.
387	17-5969	Dep.
391	17-5970	Dep.; $0.25(BIS), 1s. 9d. (HMSO)
402	17-5971	Dep.; $0.21(BIS), 1s. 6d. (HMSO)
403	17-5972	Dep.; $0.21(BIS), 1s. 6d. (HMSO)
406	17-5973	Dep.
407	17-5974	Dep.
408	17-5754	Dep.; $0.21(BIS); 1s. 6d (HMSO)
414	17-5975	Dep.
PIBAL–	**(Non-AEC)**	
753	17-6797	$3.60(OTS)
PLASTEC-NOTE–		**(Non-AEC)**
5	17-6318	$0.75(OTS)
PRDC-TR–		
59	17-7563	Dep.(mc); $2.60(fs), $0.86(mf) OTS
60	17-7608	Dep.(mc); $1.60(fs), $0.80(mf) OTS
PST-Cat.–	**(Misc.)**	
816*	17-7527	See NASA-TT-F-98
PUC–		
1962-56	17-6402	Dep.(mc); $10.10(fs), $3.89(mf) OTS
1962-59	17-7137	Dep.(mc); $9.10(fs), $3.50(mf) OTS
1962-61	17-7138	Dep.(mc); $1.10(fs), $0.80(mf) OTS
1962-75	17-7235	Phys. Rev. 129: 681-91(1963)
1962-81	17-7217	Phys. Rev. 129: 272-82(1963)
PWA–	**(Non-AEC)**	
2128	17-6675	
PWAC–	**(Misc.)**	
89	17-7564	Dep.(mc); $2.60(fs), $0.83(mf) OTS
161	17-7565	Dep.(mc); $8.10(fs), $2.66(mf) OTS
170	17-7566	Dep.(mc); $9.10(fs), $3.50(mf) OTS
186	17-7567	Dep.(mc); $16.50(fs), $7.82(mf) OTS
189(Vol.1)	17-7568	Dep.(mc); $21.00(fs), $9.57(mf) OTS
189(Vol.2)	17-7569	Dep.(mc); $15.50(fs), $7.22(mf) OTS
206	17-7570	Dep.(mc); $6.60(fs), $2.24(mf) OTS
R–	**(Misc.)**	
191*	17-6313	See NP-12349
1852-2*	17-6796	See NP-12332
2149	17-6565	See EURAEC-413
RAD-SR–	**(Non-AEC)**	
62-251	17-6045	
RADC-TDR–	**(Misc.)**	
62-254*	17-6403	$1.60(OTS)
62-401*	17-6676	
RISÖ–	**(Danish)**	
48	17-6677	Dep.(mc)
RM–	**(Misc.)**	
2947-AEC	17-6798	Dep.(mc); $5.60(fs), $1.79(mf) OTS
3399-PR*	17-6955	
RRL–	**(Misc.)**	
76	17-6144	Intern. J. Appl. Radiation Isotopes 13: 493-9(1962)
78T	17-6130	Dep.(mc); $1.10(fs), $0.80(mf) OTS
RT-BIO–	**(Italian)**	
(62)70	17-5863	Nuntius Radiol. 28: 371-83(1962)
RT-EL–	**(Italian)**	
(62)16	17-6447	Comit. Naz. Energia Nucl. Notiziario 8: No. 6, 11p. (1962)
RT-FI–	**(Italian)**	
(62)36	17-7440	Comit. Naz. Energia Nucl. Notiziario 8: No. 4, 13p. (1962)
(62)42	17-7070	Rend. Seminario Mat. Fis. Milano 32: 18p. (1962)
RT-ING–	**(Italian)**	
(62)7	17-7618	Comit. Naz. Energia Nucl. Notiziario 8: No. 4, 12p. (1962)
(62)8	17-7629	Comit. Naz. Energia Nucl. Notiziario 8: No. 6, 8p. (1962)
SAM-TDR–	**(Non-AEC)**	
62-68	17-5908	$1.60(OTS)
62-99	17-5676	$1.10(OTS)
SCDC–		
2602X	17-6407	See TID-15453
2827	17-5658	See TID-16647
2936	17-6247	See TID-17498
2952	17-6505	See TID-17315
SCL-T–		
446	17-6117	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
447	17-6412	Dep.(mc); $1.60(fs), $0.80(mf) JCL
449	17-6413	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
451	17-6699	Dep.(mc); $1.10(fs), $0.80(mf) JCL
SCTM–		
39-62(25)	17-6598	Dep.(mc); $1.10(fs), $0.80(mf) OTS
144-62(24)	17-6500	Dep.(mc); $1.10(fs), $0.80(mf) OTS
168-60(24)	17-6404	Dep.(mc); $2.60(fs), $0.89(mf) OTS
219-62(73)	17-6206	Dep.(mc); $2.60(fs), $0.98(mf) OTS
233-62(14)	17-6229	Dep.(mc); $1.60(fs), $0.80(mf) OTS
364-61(73)	17-6405	Dep.(mc); $7.60(fs), $2.36(mf) OTS
SRO–		
75	17-7609	Dep.(mc); $1.10(fs), $0.80(mf) OTS
SSD-TDR–	**(Non-AEC)**	
62-146	17-7428	See NP-12342
STI-PUB–	**(International Atomic Energy Agency)**	
58	17-6104	$11.00; 66s; NF 44; DM 38.50(IAEA)
59	17-6583	Proceedings of the Conference on Corrosion of Reactor Materials Held by the Inter-

Report No.	Abstract No.	Availability
		national Atomic Energy Agency at Salzburg, Austria, June 4–8, 1962. IAEA, $10.00
SY–	**(Non-AEC)**	
5396-R2	17-7610	$8.60(OTS)
TDR–	**(Non-AEC)**	
69(2230-04) TN-2	17-6786	See DCAS-TDR-62-133
169(3210-02) TN-1	17-7428	See NP-12342
930(2210-14) TR-1	17-7538	See DCAS-TDR-62-44
930(2230-05) TN-4	17-7424	See DCAS-TDR-62-42
TID–		
3714	17-5657	Dep.; Free(DTIE)
7625	17-6524	Dep.; $1.50(OTS)
12729	17-5703	Dep.(mc); $1.60(fs), $0.80(mf) OTS
12790	17-5704	Dep.(mc); $3.60(fs), $1.25(mf) OTS
13145	17-6046	Dep.(mc); $1.10(fs), $0.80(mf) OTS
13148	17-6406	Dep.(mc); $2.60(fs), $0.89(mf) OTS
13249	17-5938	Dep.(mc); $1.10(fs), $0.80(mf) OTS
13275	17-5771	Dep.(mc); $1.60(fs), $0.80(mf) OTS
13322	17-5772	$2.60(fs), $0.86(mf) OTS
13363	17-6131	Dep.(mc); $1.10(fs), $0.80(mf) OTS
13384	17-5939	Dep.(mc); $1.60(fs), $0.80(mf) OTS
13613	17-5773	Dep.(mc); $1.60(fs), $0.80(mf) OTS
13705	17-6956	$9.60(fs), $3.59(mf) OTS
13984	17-5774	Dep.(mc); $3.60(fs), $1.19(mf) OTS
13996	17-5725	J. Occupational Med. 4: 199-201(1962)
14019	17-5909	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14155	17-6501	Dep.(mc); $1.10(fs), $0.80(mf) OTS
14262	17-7057	Dep.(mc); $1.10(fs), $0.80(mf) OTS
14322	17-6762	J. Nucl. Mater. 7: 85-91(1962)
14495	17-7611	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14508	17-6678	Dep.(mc); $2.60(fs), $1.04(mf) OTS
14529	17-5775	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14532	17-6502	Quart. Appl. Math., 20: 257-65(1962)
14533	17-6116	Dep.(mc); $1.10(fs), $0.80(mf) OTS
14535	17-6047	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14538	17-6048	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14550	17-6230	Dep.(mc); $5.60(fs), $1.70(mf) OTS
14592	17-5976	Dep.(mc); $1.10(fs), $0.80(mf) OTS
14598	17-6187	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14604	17-5705	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14608	17-7194	J. Inorg. Nucl. Chem. 24: 589-92(1962)
14613	17-5677	Dep.(mc); $2.60(fs), $0.92(mf) OTS
14697	17-7612	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14698	17-5776	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14708	17-6799	Dep.(mc); $4.60(fs), $1.43(mf) OTS
14799	17-7139	Dep.(mc); $3.60(fs), $1.22(mf) OTS
14893	17-5706	Dep.(mc); $1.10(fs), $0.80(mf) OTS
14920	17-6503	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14921	17-7140	Dep.(mc); $2.60(fs), $0.92(mf) OTS
15070	17-5977	Dep.(mc); $2.60(fs), $0.86(mf) OTS
15165	17-7058	Dep.(mc); $2.60(fs), $0.83(mf) OTS
15181	17-5777	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15182	17-7141	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15183	17-6049	Dep.(mc); $2.60(fs), $0.95(mf) OTS
15270	17-6679	Dep.(mc); $2.60(fs), $1.28(mf) OTS
15271	17-6188	Dep.(mc); $3.60(fs), $1.19(mf) OTS
15274	17-6083	J. Inorg. Nucl. Chem. 24: 641-4(1962)
15280	17-6573	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15281	17-6574	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15308	17-5707	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15313	17-6189	Dep.(mc); $2.60(fs), $0.95(mf) OTS
15319	17-5978	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15323	17-6050	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15342	17-6942	Dep.(mc); $2.60(fs), $1.04(mf) OTS
15359	17-5979	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15360	17-6051	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15445	17-6319	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15453	17-6407	Dep.(mc); $3.60(fs), $1.16(mf) OTS
15495	17-6800	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15512	17-5980	Dep.(mc); $2.60(fs), $0.83(mf) OTS
15521	17-5778	$3.60(fs), $1.31(mf) OTS
15527	17-6504	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15530	17-6438	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15535	17-7345	$1.60(fs), $0.80(mf) OTS
15539	17-6680	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15542	17-6749	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15548	17-7142	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15608	17-7635	Dep.(mc); $2.60(fs), $0.95(mf) OTS
15677	17-7628	Dep.(mc); $2.60(fs), $1.01(mf) OTS
15720	17-5940	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15991	17-6150	J. Chem. Phys. 37: 1908-17(1962)
16140	17-6220	Rev. Sci. Instr. 33: 1288-9(1962)
16207	17-5985	Anal. Chem. 34: 1692-5(1962)
16318	17-6980	Phys. Rev. 129: 427-33(1963)
16342	17-7228	Phys. Rev. 129: 353-61(1963)
16433	17-7224	Phys. Rev. 129: 320-3(1963)
16525	17-6465	Rev. Sci. Instr. 33: 1231-4(1962)
16553	17-6320	Dep.; $2.00(OTS)
16600	17-6462	Rev. Sci. Instr. 33: 1153-60(1962)
16631	17-6994	Phys. Rev. 129: 981-90(1963)
16647	17-5658	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16664	17-7247	Phys. Rev. 129: 765-8(1963)
16847	17-6530	Dep.; $2.25(OTS)
16901	17-6135	Anal. Chem. 35: 2-6(1963)
17118	17-6467	Rev. Sci. Instr. 33: 1258-64(1962)
17138	17-7244	Phys. Rev. 129: 754-6(1963)
17226	17-6273	Dep.; $2.75(OTS)
17239	17-5941	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17272	17-6132	Dep.(mc); $10.50(fs), $4.37(mf) OTS
17303	17-6801	Dep.(mc); $18.50(fs), $8.96(mf) OTS
17315	17-6505	$3.60(fs), $1.19(mf) OTS
17336	17-7429	Dep.(mc); $2.60(fs), $0.83(mf) OTS
17337	17-6133	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17340	17-6599	Dep.(mc); $6.60(fs), $2.09(mf) OTS
17348	17-6802	Dep.(mc); $10.50(fs), $4.34(mf) OTS
17350	17-6506	Dep.(mc); $4.60(fs), $1.55(mf) OTS
17357(Pt.I)	17-6957	Dep.(mc); $3.60(fs), $0.86(mf) OTS
17357(Pt.II)	17-7143	Dep.(mc); $8.10(fs), $2.81(mf) OTS
17357(Pt.III)	17-7144	Dep.(mc); $11.50(fs), $4.82(mf) OTS
17379	17-5910	Dep.(mc); $3.60(fs), $1.25(mf) OTS
17382	17-6750	Dep.(mc); $4.60(fs), $1.46(mf) OTS
17384	17-6575	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17386	17-6576	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17402	17-7571	Dep.(mc); $2.60(fs), $1.10(fs) OTS
17406	17-6751	Dep.(mc); $6.60(fs), $2.24(mf) OTS
17413	17-6052	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17429	17-7346	Dep.(mc); $2.60(fs), $1.04(mf) OTS
17447	17-6053	$1.10(fs), $0.80(mf) OTS
17467	17-6274	Dep.(mc); $7.60(fs), $2.48(mf) OTS
17492	17-6681	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17495	17-6682	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17498	17-6247	$16.50(fs), $7.97(mf) OTS
17504	17-6531	Dep.(mc); $2.60(fs), $0.95(mf) OTS
TM–	**(Misc.)**	
3543-67*	17-6519	See NP-12293
TO-B–	**(Non-AEC)**	
62-64	17-6258	See NDL-TR-41
TRG-REPORT–	**(Non-AEC)**	
246	17-6419	J. Sci. Instr. 39: 642-4(1962)
294	17-6207	Dep.; $0.42(BIS), 3s. (HMSO)
306	17-7572	Dep.; $0.42(BIS), 3s. (HMSO)
342	17-6321	Dep.(mc); $0.42(BIS); 3s. (HMSO)
UAC–		
4779	17-6501	See TID-14155

Report No.	Abstract No.	Availability
5151	17-6636	See ANL-FGF-247
5205	17-5771	See TID-13275
5243	17-5938	See TID-13249
5554	17-5909	See TID-14019
5624	17-6201	See ANL-FGF-300
5717	17-5976	See TID-14592
5720	17-5705	See TID-14604
5783	17-7612	See TID-14697
5786	17-5776	See TID-14698
5817	17-6799	See TID-14708
5883	17-7140	See TID-14921
5893	17-5706	See TID-14893
5894	17-6503	See TID-14920
5922	17-6188	See TID-15271
5934	17-5978	See TID-15319
5971	17-6050	See TID-15323
5972	17-6679	See TID-15270
6011	17-5707	See TID-15308
6016	17-6189	See TID-15313
6032	17-6749	See TID-15542
6043	17-5980	See TID-15512
6095	17-6637	See ANL-FGF-321
6104	17-6438	See TID-15530
6121	17-7635	See TID-15608
6150	17-5778	See TID-15521
6165	17-6504	See TID-15527
6361	17-6638	See ANL-FGF-343
6511	17-6702	Appl. Phys. Letters 1: 55-6(1962)
6851	17-6053	See TID-17447
6868	17-6473	To be published in TID-7642
6873	17-7346	See TID-17429
6904	17-6052	See TID-17413
UCLA–		
497	17-5755	Dep.(mc); $1.60(fs), $0.80(mf) OTS
499	17-6322	Dep.(mc); $1.60(fs), $0.80(mf) OTS
UCRL–		
5979	17-6439	Dep.(mc); $2.60(fs), $0.86(mf) OTS
6081(Rev.)	17-6215	Phys. Today 14: 24-34(1961)
6387	17-7430	Dep.(mc); $4.60(fs), $1.43(mf) OTS
6389	17-6803	Dep.(mc); $2.60(fs), $0.83(mf) OTS
6404	17-7145	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6404(Rev.1)	17-7240	Phys. Rev. 129: 727-32(1963)
6452(Pt.II)	17-6683	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6477	17-6275	Dep.(mc); $3.60(fs), $1.13(mf) OTS
6499-T	17-6834	J. Chem. Phys. 37: 1988-90(1962)
6500	17-6054	Dep.(mc); $2.60(fs), $0.92(mf) OTS
6531	17-6408	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6561	17-7431	Dep.(mc); $2.60(fs), $0.83(mf) OTS
6562	17-7432	Dep.(mc); $3.60(fs), $1.19(mf) OTS
6621	17-7573	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6630-T	17-6804	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6670-T	17-7448	Intern. Sci. Technol., No. 2, 34-41(1962)
6701	17-6109	p.529-48 of "Thermodynamics of Nuclear Materials." Vienna, IAEA, 1962
6702	17-6805	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6748	17-6684	Dep.(mc); $2.60(fs), $0.95(mf) OTS
6761	17-7636	Dep.(mc); $2.60(fs), $1.04(mf) OTS
6771	17-7466	Phys. Fluids 6: 124-41(1963)
6792-T	17-6917	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6793	17-6409	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6808-T(Rev.)	17-6861	Phys. Rev. 129: 190-3(1963)
6856	17-7465	Phys. Fluids 6: 116-24(1963)
6907	17-7456	Phys. Fluids 6: 48-57(1963)
7052	17-6806	Dep.; $0.75(OTS)
7091	17-6958	Dep.(mc); $2.60(fs), $0.98(mf) OTS
7118	17-6055	Dep.; $1.25(OTS)
9288(Rev.)	17-6959	Phys. Rev., 128: 869-84(1962)
9659	17-5942	Dep.(mc); $2.60(fs), $1.07(mf) OTS
9764	17-7146	Dep.(mc); $2.60(fs), $1.10(mf) OTS
9793	17-6960	Dep.(mc); $1.10(fs), $0.80(mf) OTS
9807	17-6410	Dep.(mc); $3.60(fs), $1.16(mf) OTS
9819	17-6807	$2.60(fs), $0.98(mf) OTS
9824(Rev.)	17-6808	Rev. Sci. Instr., 34: 104-5(1963)
9889	17-6961	Dep.(mc); $3.60(fs), $1.16(mf) OTS
9911	17-7147	Dep.(mc); $3.60(fs), $1.28(mf) OTS
9916	17-7386	Nucl. Instr. Methods 18,19: 309-22(1962)
9924	17-6134	Dep.(mc); $1.10(fs), $0.80(mf) OTS
9967	17-6323	Dep.(mc); $4.60(fs), $1.43(mf) OTS
9971	17-7433	Dep.(mc); $3.60(fs), $1.31(mf) OTS
9992	17-6685	Dep.(mc); $1.60(fs), $0.80(mf) OTS
9996	17-7148	Dep.(mc); $3.60(fs), $1.13(mf) OTS
10012	17-6686	Dep.(mc); $2.60(fs), $0.89(mf) OTS
10020	17-7412	Nucl. Instr. Methods 18,19: 613-21(1962)
10021	17-7378	Nucl. Instr. Methods 18,19: 184-93(1962)
10030	17-6440	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10065	17-7347	Dep.(mc); $2.60(fs), $0.83(mf) OTS
10066	17-7405	Nucl. Instr. Methods 18,19: 552-8(1962)
10067(Rev.)	17-7404	Nucl. Instr. Methods 18,19: 525-47(1962)
10068	17-7348	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10070	17-7349	Dep.(mc); $2.60(fs), $0.83(mf) OTS
10071	17-7389	Nucl. Instr. Methods 18,19: 347-61(1962)
10072	17-7390	Nucl. Instr. Methods 18,19: 362-9(1962)
10074	17-7373	Nucl. Instr. Methods 18,19: 135-47(1962)
10076	17-7415	Nucl. Instr. Methods 18,19: 634-8(1962)
10077	17-7409	Nucl. Instr. Methods 18,19: 589-94(1962)
10079(Rev.)	17-7414	Nucl. Instr. Methods 18,19: 627-33(1962)
10080	17-7406	Nucl. Instr. Methods 18,19: 571-5(1962)
10081	17-7355	Nucl. Instr. Methods 18,19: 33-40(1962)
10082	17-7407	Nucl. Instr. Methods 18,19: 576-81(1962)
10083	17-7384	Nucl. Instr. Methods 18,19: 295-302(1962)
10085	17-7350	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10086	17-7393	Nucl. Instr. Methods 18,19: 405-16(1962)
10124	17-6687	Dep.(mc); $1.10(fs), $0.80(mf) OTS
10176	17-6105	p.61-70 of "Thermodynamics of Nuclear Materials." Vienna, IAEA, 1962
10199	17-7219	Phys. Rev. 129: 290-6(1963)
10376	17-6987	Phys. Rev. 129: 872-6(1963)
10400	17-6221	Rev. Sci. Instr. 33: 1291-2(1962)
10428	17-7000	Phys. Rev. Letters 9: 330-2(1962)
10430	17-6880	Phys. Rev. Letters 9: 347-8(1962)
10461	17-7149	Dep.; $2.25(OTS)
UCRL-Trans–		
838(L)	17-6326	Dep.(mc); $1.60(fs), $0.80(mf) JCL
887(L)	17-6814	Dep.(mc); $1.60(fs), $0.80(mf) JCL
892(L)	17-6700	Dep.(mc); $1.10(fs), $0.80(mf) JCL
UCSF–		
22	17-5779	Dep.; $2.00(OTS)
UNC–	**(Misc.)**	
5042	17-7613	Dep.(mc); $3.60(fs), $1.34(mf) OTS
USNRDL-TR–	**(Non-AEC)**	
581	17-6441	$8.10(OTS)
582	17-6324	$5.00(OTS)
583	17-5780	$2.60(OTS)
592	17-6442	$1.60(OTS)
594	17-7498	$1.10(OTS)
598	17-6443	$1.60(OTS)
UTIA-REV–	**(Non-AEC)**	
18	17-7434	
VDIT–	**(Swedish)**	
66	17-5981	Dep.(mc)
WADC-TR–	**(Non-AEC)**	
53-373(Suppl.9)	17-6532	OTS

Report No.	Abstract No.	Availability
WADD-TR–	**(Non-AEC)**	
60-37(Pt.III)	17-6688	OTS
60-371	17-6411	OTS
WAL-TR–	**(Non-AEC)**	
851.4/2	17-6689	
WAPD–	**(Misc.)**	
264	17-6752	Dep.; $3.00(OTS)
WAPD-MRP–		
100	17-7614	Dep.; $2.50(OTS)
WAPD-T–		
1225	17-7574	Dep.(mc); $3.60(fs), $1.22(mf) OTS
1268	17-6690	Dep.(mc); $2.60(fs), $0.89(mf) OTS
1274	17-6755	Am. Soc. Testing Mater., Spec. Tech. Publ. 306: 64-85(1961)
1335	17-6691	Dep.(mc); $1.60(fs), $0.80(mf) OTS
1402	17-6753	Dep.(mc); $1.60(fs), $0.80(mf) OTS
1545	17-7615	Dep.(mc); $2.60(fs), $0.95(mf) OTS
WRU–		
202	17-6056	Dep.(mc); $1.60(fs), $0.80(mf) OTS
WT–	**(Misc.)**	
502*	17-6276	Dep.(mc); $2.60(fs), $1.07(mf) OTS
XDC–		
61-3-66	17-6208	Dep.(mc); $12.00(fs), $5.24(mf) OTS

DEPOSITORIES OF USAEC REPORTS

In Countries Other than the U.S.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica
AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission
AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institute der Universität
BELGIUM
Mol-Donk, Centre d'Etude de l'Energie Nucleaire
BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao
São Paulo, Instituto de Energia Atomica,
Rangoon, Union of Burma Applied Research
BURMA
Cidade Universitaria São Paulo
Institute, Atomic Energy Center Library
CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia
CEYLON
Colombo, University of Ceylon
CHILE
Santiago, Instituto de Fisica y Matematicas, Universidad de Chile
CHINA
Hsinchu, Taiwan, Free China, National Tsing Hua University
COLOMBIA
Bogota, Instituto De Asuntos Nucleares
COSTA RICA
San Pedro, University of Costa Rica Library
DENMARK
Risö, Danish Atomic Energy Commission
DOMINICAN REPUBLIC
Santo Domingo, Comisión Nacional de Asuntos Nucleares
ECUADOR
Quito, Escuela Politécnica Nacional
EGYPT
Cairo, Atomic Energy Commission
EL SALVADOR
San Salvador, Universidad de El Salvador, Biblioteca de Energia Nuclear
ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
ENGLAND (CONT.)
Manchester, Central Library
Newcastle upon Tyne, Central Library
Nottingham, Central Library
Sheffield, Central Library
FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto
FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences
GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek
GHANA
Accra, University College of Ghana
GREECE
Athens, Greek Atomic Energy Commission
GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear
HAITI
Port au Prince, University of Haiti
HONDURAS
Tegucigalpa, Comisión Hondureña de Energía Atómica
ICELAND
Reykiavik, University of Iceland, Atomic Energy Library
INDIA
Bombay, Department of Atomic Energy
INDONESIA
Bandung, Java, Bandung Institute of Technology
Djogjakarta, Java, Science Faculty, Gadjah Mada University
IRAN
Tehran, Tehran University Center for Nuclea Studies
IRAQ
Baghdad, Iraqi Atomic Energy Commission
IRELAND
Dublin, University College
ISRAEL
Rehovoth, Israel Atomic Energy Commission
ITALY
Rome, Centro di Studi Nucleari della Casaccia
Rome, Comitato Nazionale per l'Energia Nucleare
JAPAN
Tokyo, National Diet Library
KOREA
Seoul, Office of Atomic Energy
LEBANON
Beirut, American University
LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity
MALAYA
Kuala Lumpur, University of Malaya
MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear
NETHERLANDS
The Hague, Reactor Centrum Nederland
NEW ZEALAND
Wellington, Department of Scientific and Industrial Research
NORTHERN IRELAND
Belfast, City Library
NORWAY
Lillestrøm, Institutt för Atomenergi
PAKISTAN
Lahore, West Pakistan, Atomic Energy Centre
PERU
Lima, Junta de Control de Energia Atomica
PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission
POLAND
Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej
PORTUGAL
Sacavem, Junta de Energía Nuclear
REPUBLIC OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library
REPUBLIC OF THE CONGO
Leopoldville, Université Lovanium
SCOTLAND
Glasgow, Mitchell Library
SPAIN
Madrid, Junta de Energía Nuclear, Biblioteca Documentación y Publicaciones, Ciudad Universitaria
SWEDEN
Nyköping, Aktiebolaget Atomenergi
SWITZERLAND
Zurich, Institut für Physik, Eidg. Technische Hochschule
THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science
TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library
URUGUAY
Montevideo, Comision Nacional de Energia Atomica
VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Científicas
VIET-NAM
Dalat, Institute of Nuclear Research, Atomic Energy Office
YUGOSLAVIA
Belgrade, Federal Commission for Nuclear Energy

In International Agencies

AUSTRIA
Vienna, International Atomic Energy Agency

BELGIUM
Brussels, La Bibliotheque EURATOM

FRANCE
Paris, European Nuclear Energy Agency, O.E.C.D.

ITALY
Ispra, EURATOM Research Center

SWITZERLAND
Geneva, United Nations Library

UNITED STATES
Washington, D. C., Inter-American Nuclear Energy Commission

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)